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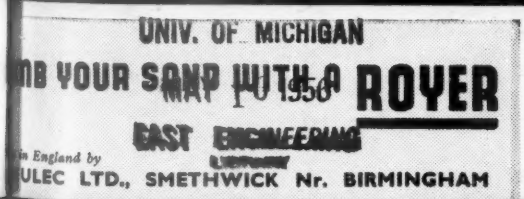

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Importance of Overseas Students

The remarks we recently made on the subject of foundry text-books apply with even greater force to the granting of scholarships tenable in this country to overseas students. The pioneer benefactor in this field was Cecil Rhodes and the results of his foresight have indeed been outstanding. Since that time, the system he inaugurated has been expanded to embrace the fields of industry and technology. In the former case, many of the larger concerns, when installing or operating plant overseas, train in their home plant, a national of the country concerned. Similarly, when opening or extending an agency abroad, many firms find it advantageous to provide a course of instruction at home for a member of the overseas staff. The Federation of British Industries has already granted scholarships to no fewer than 100 overseas students to enable them to spend a period at one of the larger—usually engineering—works in this country, at a cost of about £1,000 per man. The feature of these scholarships is that the recipients are hand-picked by the Federation, in association with a local committee, and never nominated by the local government or other authorities.

On the other hand, university and technological students from overseas are as often as not sponsored by some national authority of the country from which they emanate. In addition, there is an organization which arranges for university students to take vacation courses in works abroad, and many thousands of students have availed themselves of this privilege. Within the International Committee of Foundry Technical Associations, there is also a scheme for the placing of students abroad.

The outcome of most, but not all, of these schemes is that there is engendered in the student a bias in favour of the country where he was trained. It is not so, however, where the trainee or student cannot get suitable employment back home; then, he tends to become a revolutionary. By and large, those trained in British engineering works do not suffer from lack of employment on return home, and quite often make such progress in their profession that they can, and do, place large orders for British plant and equipment. Thus, the reception of overseas students in our industrial plants and universities and colleges, ranks among the best type of advertisement for British industry. It is unfortunate that most schemes are only applicable to the largest concerns, but the small foundry owner can often effect an exchange between a suitable boy in his organization and a European lad of a similar type. It is almost certain that such efforts will not increase industrial competition but will add a quota to the world's stock of applied technology and inculcate a respect for each others' way of life.

Correspondence

RISING PRICES

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The Foundry Trades' Equipment & Supplies Association, Limited, has taken notice of the request by Her Majesty's Government, that efforts should be made to stabilize prices. To this end, the Council of the Association have given their very serious consideration and investigation.

With regard to the manufacturers and suppliers of consumable foundry stores, such as core-oils, blackings, etc., the main factor causing price increases is the cost of the raw materials which have to be used. The majority of these are (*a*) imported from various countries, or (*b*) supplied by the nationalized industries. It is apparent therefore that the Association is powerless to prevent these rising costs of raw materials.

To an extent, the same remarks apply to foundry machinery and equipment, but here wage increases have an important bearing on costs.

The Council of the Association was satisfied that its members had, so far as possible, absorbed the increased costs and that the increases in prices which have been made from time to time were unavoidable, and were for reasons quite beyond the control of the members of the Association.—Yours, etc.,

C. ORTON FOSTER,
President.

The Foundry Trades' Equipment & Supplies Association, Limited,
94/98, Petty France,
London, S.W.1. April 14, 1956.

Death of Mr. J. K. Clements

The death of Mr. J. K. Clements, which occurred suddenly on April 9, is widely mourned in South Wales where he was a prominent member of the Wales & Monmouth branch of the Institute of British Foundrymen. The son of the late Mr. W. E. Clements, the founder of the firm of Thomas & Clements, Limited, the deceased was director and works manager of the Glanmor Foundry Company, Limited, of Llanelly—a foundry which has amalgamated with Thomas & Clement.

New Institute of Metals President

Major C. J. P. Ball was inducted as president of the Institute of Metals for 1956-57 at the Institute's annual general meeting held in London recently. Major Ball is chairman of Magnesium Elektron, Limited, a position he has held since the company's formation in 1934. Until August of last year he was also managing director of the company. He is also on the boards of a number of other companies, including Sterling Metals, Limited. The Institute's new vice-presidents are Dr. N. P. Inglis, research director of the metals division of Imperial Chemical Industries, Limited, Birmingham, and Dr. Ivor Jenkins, chief metallurgist of the research laboratories of the General Electric Company, Limited, Wembley (Middx). The council has elected Dr. L. B. Pfeil, FRS, a director of the Mond Nickel Company, Limited, to be senior vice-president.

Basic Materials Prices Rise

A slight rise was recorded last month in the overall level of prices of basic materials—excluding fuel—used in British industry. According to the Board of Trade's monthly index (June 30, 1949=100), average raw material prices advanced by 0.6 per cent. to 155.8 in March. One of the commodities which showed a fairly substantial rise in price was copper (up 4.6 per cent.), while lead rose by 1.5 per cent. and zinc by 1.2 per cent. The indices for materials used in the mechanical engineering and electrical machinery industries rose respectively by 0.9 per cent. and 1.7 per cent. last month. Higher prices for various non-ferrous metals were responsible for both increases: brass ingots rose by 5 per cent. in value and copper sheets by 4.4 per cent.

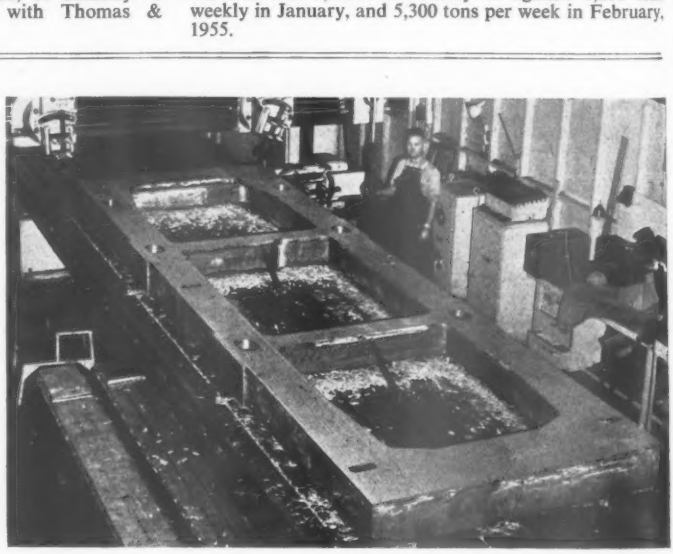
Latest Foundry Statistics—Correction

In the figures reported under the heading "Latest Foundry Statistics" in the April 19 issue of the JOURNAL, it should have been made clear that the figures for the production of castings were weekly averages for the months reported and not totals. Thus, in February the rate was 6,500 tons weekly as against 6,200 tons weekly in January, and 5,300 tons per week in February, 1955.

Cast Jigs Replace Weldments

The accompanying illustration shows a cast-aluminium end-gate jig being machined at the Boeing aeroplane works at Seattle, U.S.A., weighing 2.4 tons, it is employed for wing-component assembly, and replaces a weldment previously used for this purpose. As a result of experience gained with castings of this nature, other items have been commissioned, notably a 17 by 7 ft. expansion beam weighing 2¼ tons, also for aircraft wing jigs.

Aluminium was selected as the metal to be used because its coefficient of thermal expansion was essential to the maintenance of close dimensional tolerances in the assembly of the wings. It was also possible to use considerable scrap in making the castings, thus accounting for some of the savings that were realised.



Running and Gating of Castings*

[ABRIDGED]

By W. Collinge

MR. COLLINGE for the last four years has been foundry manager of Tweedales & Smalley (1920) Limited, the well-known Lancashire textile-machinery manufacturers. His first executive appointment was foundry foreman of Whitehead & Poole, Limited, Radcliffe. Subsequently, he served for a period in India as foundry manager for Tata Aircraft at Poona, and after that as foundry adviser to the Government of India. Returning to this country he became foundry works manager of Newman Industries, Limited, and later foundry manager at Stothert & Pitt Limited.

It is now generally recognized that to compete in to-day's open market, sound castings of good finish are required. With this in mind, an attempt has been made in this Paper to outline the methods of gating which have been successfully developed, to meet the current high standard of inspection demanded. The gating systems and layouts illustrated are applicable to any type of casting of similar design, and it has been proved that the metal used has been accommodated successfully in the mould to produce castings free from general defects such as porosity, gas-inclusions and scabbing. This Paper deals mainly with a number of light- to medium-weight iron castings. In this age of mechanization it must be borne in mind that metal has to be distributed rapidly about the foundry and poured into moulds at as high a temperature as possible so as to produce sound castings; also, timed casting schedules are in vogue, and melting capacity is standardized to meet the requirements of different parts of the foundry at given periods.

The company with which the Author is associated produces a large number of light and medium castings. With a daily melt of 40 tons, one must take into consideration metal distribution, the rule being to dispose of metal as quickly as possible. The foundry personnel now fully realize that pouring at high temperature entails a reduced amount of scrap from gas-inclusions or blowholes. Even a sound mould of high permeability and correct moisture-content can result in a " waster " due solely to pouring with metal at low temperature. Under such conditions, the gas given off from the burning volatile-matter in the mould becomes entrapped due to the shorter freezing time, and gas holes in the metal usually disclosed themselves during subsequent machining of the casting. Conversely, with high-temperature pouring, the metal in the mould has a longer period before freezing and this allows time for gas to escape from the moulds. However, pouring at high temperature can create other difficulties, for instance, where thin and thick sections are included in the same casting.

General Arrangements

To counter many of these difficulties, arrangements have been made wherever possible to see that the bulk of the metal is situate at the top of the mould and gates and feeders are designed to accommodate the metal in such a manner as to ensure soundness, also providing for first solidification at the bottom of the mould. Considering a suitable metal composition for a great variety of castings is a difficult problem where one is disposing of 40 tons of metal per day, and however strict the metallurgical control, wide variations of the elements are often found. When this occurs, some foundrymen are subject to what is commonly called " phosphoric jitters," and this has become more apparent during the last ten years, especially where thick sections are concerned. Others are subject to other tendencies, which is not surprising, when one sometimes runs into scrap of as high as 10 per cent. on batches of 500 to 1,000 items, all caused perhaps by a small patch of internal-shrinkage. External-shrinkage defects, too, are encountered more frequently to-day, when the foundryman is tending to use irons of higher physical strength and lower-carbon. To prevent the majority of defects in castings, the Author considers that gating methods must be a primary consideration.

Runner and Ingate Design

The first point to consider is the correct design of runner and ingate to apply. To ensure soundness from a shrinkage point of view it is imperative that feeders (atmospheric or otherwise) must be considered carefully. From the economic standpoint, the size and quantity of feeders required also must be taken into account, as they can much affect the percentage yield of saleable metal. Another matter to consider is the correct design of runners, etc., to be used to ensure equal distribution of metal in the mould, avoiding hot-spots and stresses which

* Paper read before the Burnley section of the Lancashire branch of the Institute of British Foundrymen.

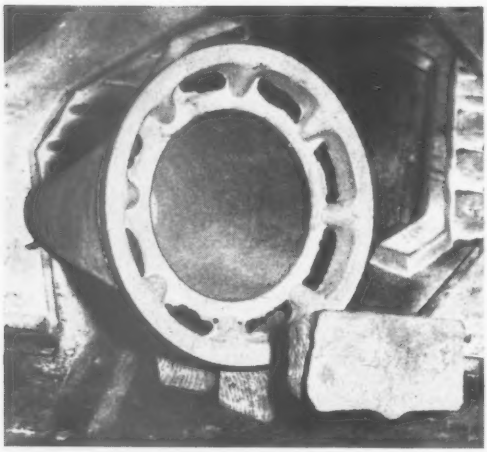


FIG. 1.—*Cone-drum casting for the textile industry, showing the method of running adopted.*

are frequently due to gating being concentrated at one point of the casting. Concentrated gating is the chief cause of turbulence, which produces dross and scum in front of an ingate, caused by the swift rush of metal at a single point and resulting in rough casting finish or even scabbing. Dirt-trap design must also be well considered, so as to ensure the entrapment of loose sand and slag before it enters the mould. Since the introduction of a higher standard of inspection, the gating systems to be described have met with a very high degree of success and have been responsible for a great reduction in " wasters."

The Author next proposes to outline the running, gating and feeding methods adopted for a number of castings, typical of those encountered in the textile foundry industry.

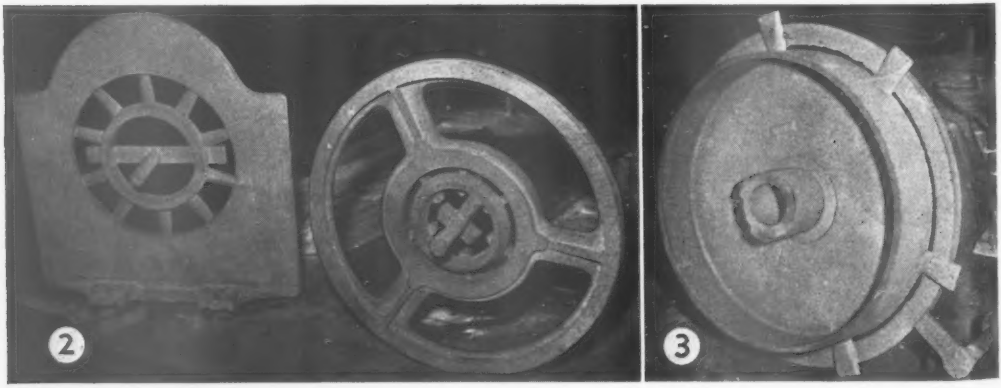
Cone Drum

The cone drum (Fig. 1) is a casting used in the textile industry, which, after machining is completed, must retain a very smooth and highly-polished surface to avoid the plucking of cotton strands. The pressure of just one very small hole, even of pin-head size, on such a casting, means rejection. As can be seen in the illustration, a ring runner with multiple ingates has been introduced, comprising eight ingates which just abut the top of the rim by $\frac{1}{8}$ in. at the furthest point; the downgate is $\frac{7}{8}$-in. dia. The casting weighs 28 lb. and has a wall thickness of $\frac{1}{2}$ in., a diameter of 12 in. tapering to 8 in., and is 12-in. long with a 1-in. thick plate section on the base. The even distribution of metal entry at the eight points should be noted, as little disturbance is occasioned, the dirt being trapped within the ring. A machine-made mould is used for the cone drum, covered by a top core which accommodates the ring gate and also forms the inside of the casting. After making the casting in this way, the decrease in the number of wasters received back from the machine shop has been such that patterns for all similar designs of castings have been equipped with this gating system. The standard composition of iron used for this job and the next two to be described is TC 3.4; Si 2.1 to 2.3; Mn 0.6 to 0.7; S 0.1 max.; and P 0.7 to 0.85 per cent.

Surface-plate and Cage-end Castings

Surface-plate and cage-end castings are shown in Fig. 2 (left and right respectively). As with a cone drum, the surface plate must have a perfectly-finished skin and be machined and polished over its entire surface to permit easy travel of cotton. For running this job also, the ring runner has been introduced. The centre cross-bar shown serves as a double dirt-trap; attached to the ring are ten

FIGS. 2 AND 3.—*Further examples of castings employing ring runners, on the left is a surface-plate weighing 25 lb.; the second casting is a cage-end for a carding machine.* FIG. 3 *shows a belt pulley 18-in. dia., 2½-in. face.*



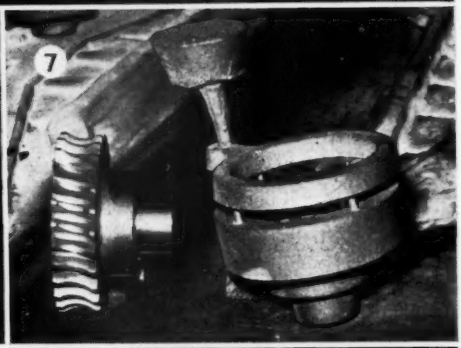


FIG. 4.—*Roller-end casting. A ring-runner and multiple-ingate system was augmented with a feeder-head topped with exothermic compound to secure soundness.*

FIG. 5.—*Compound pulley, as-cast—showing the running arrangements—and finished machined.*

FIG. 6.—*Electric-motor pulley typical of* 12 *similar jobs. This one is* 12*-in. dia., has a* 6*-in. face, and weighs* 84 *lb.*

FIG. 7.—*Worm-wheel casting and finished gear, machine moulded plus a cover core; it weighs* 20 *lb.*

FIG. 8.—*Triple-pulley* (35 *lb.*), *run by four pencil gates from a ring runner.*

ingates each $\frac{1}{8}$-in. thick at their point of entry into the casting, $\frac{1}{2}$-in. wide and radiused to prevent breaking in ; the downgate is 1-in. dia. The moulds are poured at a high temperature and the finished casting, which has outside measurements of 20 by 22 in. by $\frac{5}{8}$-in. thick, weighs 25 lb. Prior to the introduction of this type of ingate, a high percentage of wasters were found with this job due to dirt and gas-entrapment, which could be attributed to bad metal distribution and concentrated gating as a result of using an ingate on the foot of the casting.

The cage-end casting shown on the right of Fig. 2 is used on a carding machine. It is 20 in. outside dia. with an outer ring section of $\frac{3}{4}$-in. square ; the inside ring is 10-in. dia. and of $1\frac{1}{4}$-in. sq. section. Originally gating of this casting comprised one cross-bar with two ingates into the centre ring and connected to this was the downgate. A large number of wasters resulted from using this method, internal shrinkage being the major cause of the trouble, and hot-spots were formed as a result of such a concentrated flow of metal at two points. It will be noted from the illustration, which shows the gating method now in use, that the ring runner gives an even metal distribution and pressure feeding—the six ingates and crossbar having the dual purpose of acting as feeders and a dirt trap. The ingates are V-shaped, $\frac{1}{4}$-in. wide and taper from $\frac{1}{2}$ to $\frac{1}{8}$ in. This design of gate remains liquid longer than usual when the casting is poured and helps to feed the rim.

Fig. 3 shows an ordinary belt pulley, 18-in. dia. by $2\frac{1}{2}$-in. face with a wall section of $\frac{1}{2}$ in. and

FIG. 9.—*Plain belt-pulley casting weighing 78 lb. A strainer core is incorporated in the running system, and this item is also illustrated.*

FIG. 10.—*Pulley 24-in. dia., weighing 150 lb., run through short pencil gates from the head. It is fed through a slot which is opened when the metal rises to the head. The core forming the pencil gates and slot is also shown.*

weighing 15 lb. For the gating system, external ring runner and multiple ingates were again used very satisfactorily.

Roller-end Casting

A roller-end casting is shown in Fig. 4, weighing 25 lb. The ring runner and multiple ingate system has again been introduced to ensure metal cleanliness and to bring high-temperature metal to the top of the mould when pouring. This was a case where, the bulk of the metal being in the lower portion, solidification commenced at the top—which brings risks of unsoundness in the production of this type of casting. The casting is solid throughout, it has a 5-in. dia. top ring and is 6-in. dia. lower down, with a flange 2-in. thick; the lower portion of the casting measures 3-in. dia. by 11-in. long. To prevent initial solidification at the top, a 2-in. dia. feeder-head is used at this point and an exothermic compound is added on the head, with excellent results. Previously, unless the mould was poured with metal at a fairly-high temperature, wasters were frequently encountered, due to the internal porosity under the riser extending deep into the casting. A pad was incorporated under the feeder-head to eliminate breaking-in when knocking-off the feeder. The metal composition employed for this job is approximately T.C. 3.2; Si. 1.7; Mn. 0.8; S. 0.09 and P. 0.7 per cent.

Pulleys and Wheels

An illustration of a compound-pulley casting and the machined component is shown in Fig. 5, with grooves directly at the end. The casting, weighing 36 lb., is 9-in. dia. with a 2-in. thick section at the top and 6-in. dia. in the body. This type of pulley is used extensively in the textile industry. There are four atmospheric feeders attached to the casting to ensure soundness of the 2-in. thick section, where the grooves are machined and these are supplied by the ring runner and downgate, which is ¾-in. dia. The feeder-heads overlap ¼-in. on the casting and are spaced equally around the circumference. A heavy and lengthy boss is located at the centre of the casting. The gating system adopted has been successful in eliminating internal shrinkage and also produces cleaner castings, which are free from gas. The feeder-heads act as reservoirs of metal to keep the top portion liquid for a long-enough period to supply metal to the thick section and also provide time for gases to escape. A notable feature in making this casting is that the top portion is formed by segment cores which are varied in size to produce three different sizes of pulleys, 9, 8 and 7-in. dia., and these cores provide additional heat insulation at the top where it is most helpful. Any sign of porosity in the grooves results in the casting being rejected. The standard iron composition, as used for the cone drum, was employed for this casting.

An electric-motor pulley is illustrated in Fig. 6 both as-cast and machined. It has a diameter of 12-in.; a 6-in. face; weighs 84 lb., and has a wall thickness of 1¼-in. This again is run from a ring runner with five pencil runners, the downgate being 1-in. dia. The runner and pencil gates are accommodated in a cover core which is placed on top of the mould and also forms the interior of the upper half of the casting. This method of covering with a core insulates the top portion and gives to the top and bottom parts of the casting a more-equable solidification rate, thereby avoiding internal shrinkage. Twelve different sizes of motor-pulleys are produced by this method. The iron composition selected for this type of work contains T.C. 3.2; Si 1.7; Mn 0.8; S 0.09 and P 0.7 per cent.

The worm-wheel casting (and finished component) illustrated in Fig. 7 was machine moulded also using the cover-core method ring runner and four pencil gates. It weighs only 20 lb. and, when cast with iron of the same composition as recorded for the motor-pulleys, a shorter freezing-range and increased Brinell hardness is conferred, as compared with the standard iron, thus giving better wearing qualities in the finished job.

Fig. 8 shows a design of triple-pulley. Previously, this casting was run on the boss and frequently showed porosity on machining. Nowadays, five

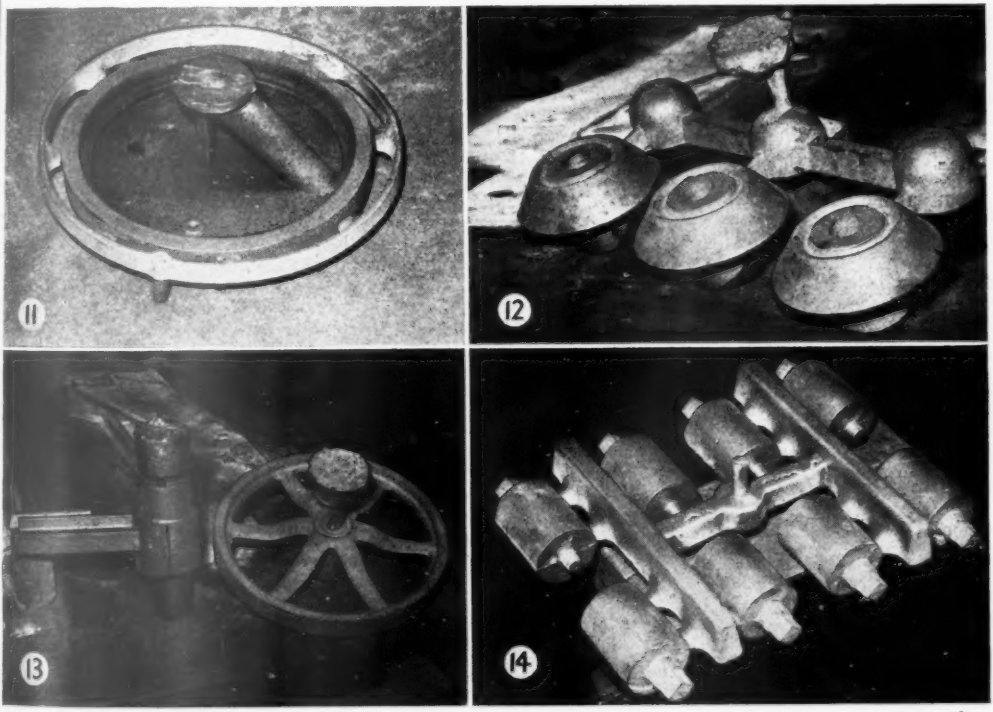
pencil-gates are attached to the plate-section of the casting. Actually these were first led to the pulley rim, but did not produce a sound casting because, after knocking off the pencil gates, small amounts of porosity and piping were found directly under the gates. The triple-pulley casting weighs 35-lb.; it is 10-in. dia., has a 4¼-in. face and a wall section of ⅝-in. Originally, scrap with this job was due to dirt- and gas-holes and porosity in the bore.

An ordinary belt pulley weighing 78-lb. is shown in Fig. 9; it is 20-in. dia. and has a ⅝-in. cross-section with a heavy boss 3½-in. dia. by 4-in. long surrounding a 1-in. dia. core. A strainer core (also illustrated in Fig. 9) is employed and is first located in moulding on a print included on the pattern. In moulding, the strainer core is contained in the top part and cannot fall out when the top is turned over because of its design. Four pencil-gates are again employed and the method has proved itself satisfactory for producing castings clean and sound in the bore, and at the same time eliminates the need for a runner-bush. In the production of other types of pulleys, some of the strainer cores are tapered the opposite way to the one seen in Fig. 9 and these are dropped into a recess in the top-part after closing the mould. A print shaped to form this recess for the core is dowelled on to the pattern and withdrawn before stripping the top-part of the mould. The belt pulley is a plate-moulded casting and is finally machined and polished.

Stoppered Runner/Feeder Cup

Fig. 10 shows a 24-in. dia. pulley weighing 150 lb. Owing to the demands of the inspection department for an extra-clean surface, this is now made face downwards, with the boss on top, the mould being hand-rammed on a stripping machine. A strainer core has again been applied in running the job, but this time slightly differently. The core employed (shown at the foot of Fig. 10) has one slot-runner and three pencil-gates. It is located by a coreprint on the pattern and rammed-up in the top-part mould, being tapered to prevent it from dropping out when the mould is turned over. The slot is not used for pouring, but for feeding. A core, in size slightly smaller than the slot, is inserted into it to a depth of ¼ in. If forced in further it will stick and not float, as intended. This small

FIG. 11.—*Tube-wheel casting, 13-in. dia., weighing 24 lb.; a ring-runner is also used for this job.* FIG. 12.—*Helical gear-blanks, cast three per box and run through individual feeder-heads.* FIG. 13 (LEFT).—*Bracket casting, weighing 20 lb., successfully run and fed through two slots 1 by 2½ in.;* (RIGHT): *Gearwheel, 20-in. dia., in the casting of which denseners are used.* FIG. 14.—*Set of eight rollers cast together and weighing 9 lb. each. The runner bars also act as feeders.*



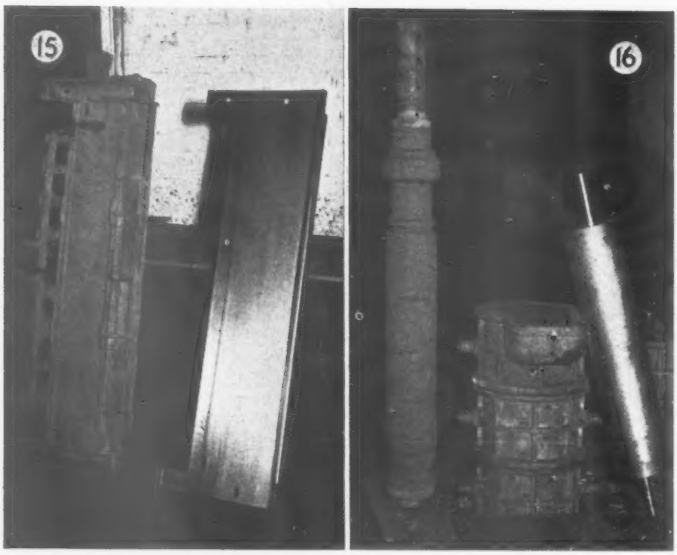


FIG. 15.—*Feed plate, weighing 130 lb. as-cast (left), and finish-machined (right). A bar added to the right-hand side of the casting obviated sponginess.*

FIG. 16 (LEFT TO RIGHT).—*Core, part of the moulding box, and finished "licker-in" roller; the casting weighs 230 lb.*

core acts in such a manner that the weight of metal in the runner keeps it in position, closing the slot, until the metal filling the mould rises in the boss and pushes it up; then the boss can receive feed-metal through the slot. To prolong feeding, an exothermic compound is used on the head.

A major point in casting design which needs special care is the thick belt of metal around the rim of the pulley, which when machined, forms a groove for a V-belt drive and no sign of porosity can be permitted. These castings are poured at a high temperature and slowly—a procedure for this particular type of casting which is effective in achieving soundness in both the boss and rim. About 250 of these castings are made per month in the Author's foundry.

With slow pouring of metal at high temperature, the metal in the heavy rim is cooling slowly whilst the rest of the mould is filling, the sand around the rim taking away heat. By the time the mould is filled, there is a situation favourable to the production of sound metal throughout the casting; the boss portion of the mould, which is the last to fill, receives the hottest metal and the runner-core also insulates the metal here; furthermore, the exothermic material extends the length of time during which the metal remains liquid, thus ensuring perfect feeding. This particular method has been practiced for over 12 months.

Tube-wheel Casting

The tube-wheel casting shown in Fig. 11 weighs 24 lb. and measures 13-in. dia., with a rim section of $\frac{7}{8}$ in. $1\frac{3}{8}$ in. and a plate section $\frac{3}{4}$-in. thick. Any sign of porosity on the rim, however small, is cause for scrapping the casting; 135 teeth are cut into the rim and inspection of this portion is very stringent. A groove is cut in the bottom portion $\frac{1}{4}$-in. deep and this also must reveal sound metal. The moulds for this job are made on a stripping machine and three parts are required. The ring runner has been introduced in this case to give even distribution of metal and also to provide metal cleanliness and uniform solidification.

Helical Gears

Fig. 12 shows three helical gear-blanks, the casting of which creates a situation suitable for the application of feeders; they are 6-in. dia. by $3\frac{1}{2}$-in. and weigh 8 lb. each. Prior to the method shown, various types of ingates were tried, the usual result being external shrinkage in the rim and internal shrinkage revealed after machining. The moulds for this job are produced on plate and machine; the bulk of the metal is in the top-part and the gates are designed to taper downwards from the feeder, and are inclined to the angle shown. They are 1-in. by $\frac{3}{8}$-in. thick.

Fig. 13 shows (left) a bracket, weighing 20 lb., the large boss of which is $4\frac{1}{2}$-in. dia. with a $1\frac{1}{2}$-in. dia. core passing through. The thick section in the centre of the boss is always the source of the trouble when machining the bore. This casting is run through two slots, 1 by $\frac{1}{2}$ in. on each side, and these serve also to convey feed metal from the head.

Fig. 13 also shows (right) a 20-in. dia. gearwheel, in the rim of which 85 teeth are subsequently cut. As-cast it has a solid boss 6-in. long, which is run through a strainer core with a $\frac{3}{8}$-in. dia. pencil gate: exothermic powder is applied to this job also to ensure adequate feeding. A notable feature in making this casting is that a densener is applied directly underneath the spokes. This densener is 1-in. deep and encircles the boss to that depth. With this application, and direct feeding as described, the tensile strength of the metal is increased around the boss adjoining the spokes. Eight blows with a hammer are required to shatter the spokes but leave the boss intact.

Eight rollers cast together on a spray are shown in Fig. 14. These are made on the firm's mechanized plant and weigh 9 lb. each; larger sizes are also produced up to a maximum of 1,400 per day. Those illustrated are $2\frac{3}{4}$-in. dia. by 4-in. long. The

gating system shown was applied over two years ago and met with such success that all roller plate-patterns were changed to this system. The previous gating system, comprising one ingate on the square end-nipple, resulted in as much as 15 to 20 per cent. scrap, through shrinkage and gas holes. The adoption of deep bars and the sweep of the ingates ensures proper feeding and cuts out turbulence. The depth of the feeding bars is governed by the diameter of the casting, and must always be ½ in. to ¾ in. deeper than half the diameter to ensure adequate feed pressure. For this job, the ingates are always set ¼ in. away from each end of the runner bar to prevent rapid cooling and this helps to give a more-uniform solidification, making sure that the ends receive the hot metal. Less than 2 per cent. scrap has been recorded since the application of this method.

Feed Plate

Fig. 15 shows a feed-plate, weighing 130 lb. Consideration of this item is included to give an appreciation of what is meant by the addition of a bar 2 ft. by 2 in. by 1 in. on the top part of the pattern which is 45 by 14 in. and has a ⅞-in. section at this position, namely opposite the ingates. The edge section here is 1¾ by 1¼ in. and drops lower than the actual plate, forming a curve. After machining, spongy patches were frequently found in the plate. Viewing the casting, one would imagine this impossible and, for years, denseners were applied in the centre to prevent sponginess, which cropped up at varying periods causing a large amount of scrap. This simple method of adding a bar on the top, as shown in the illustration, kept that lower portion liquid long enough to feed the affected part and no sign of porosity has been found since the addition of the bar.

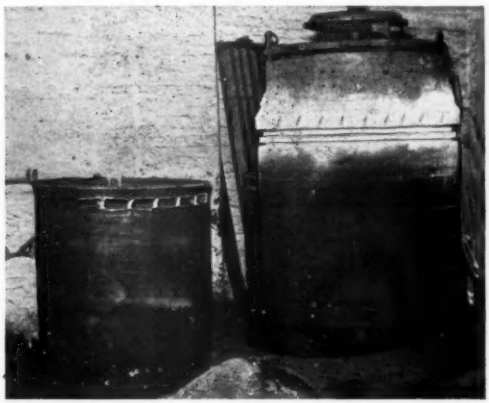
"Licker-in" Roller

Fig. 16 is a "licker-in" roller used in the cotton industry it is 9-in. dia. by 45-in. long, and as many as 50 per week are made in the Author's foundry. The illustration shows the finished casting (right), the moulding box and the core (left). Here, the core is of major importance, as it determines the length of the casting. It accommodates also the runner and the feeder head. The mould is virtually a shell and the moisture content of the sand used is kept at 7 per cent ; if lower trouble is experienced. All rollers, of various sizes, are cast in green sand and founders will realise the difficulties encountered in producing a mould of such dimensions in this medium. They are cast vertically as illustrated and poured with metal at high temperature ; the wall section is ½-in. thick and the machining allowance ¼ in. Consideration of this item brings to mind the general query made recently—Is green-sand moulding deteriorating?* One considers first the depth and weighs up the possibility of scum rising when metal is poured from that height ; again the metal pressure exerted at such a depth of mould can cause substantial "swelling" of the casting.

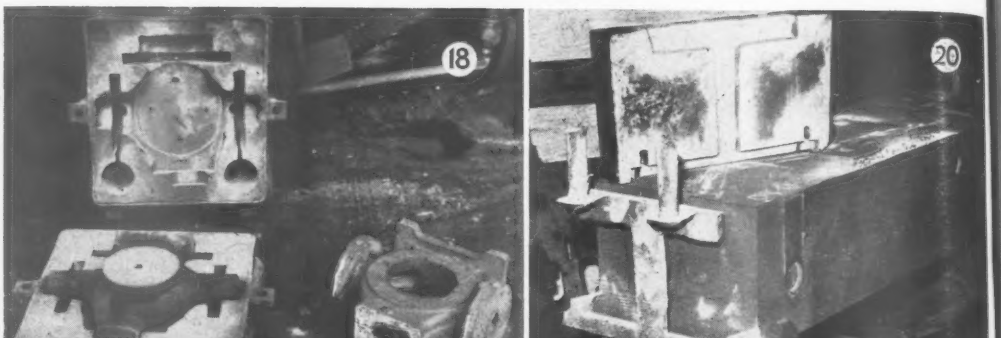
Five ingates, ½ in. by ¼ in., are employed in the top rim of the core for this roller. They are situate directly underneath the feeder-head which is essential—because of the high-temperature pouring—to ensure feeding of the flange below. It will be noted that the lower end of the core is tapered, and when lowered into the mould cavity the core seals off the mould as it seats in the bottom. The method of manufacture described has been the most successful, as running this casting from the bottom proved disastrous, through the build-up of scum during the filling of the mould which became trapped between the wall of the mould and the core. Running from the top does not permit such scum to coagulate as it is continually being broken-up on its way to the top. A typical weight for these castings is 1 to 2 cwt.; they are made of the standard iron-composition.

Fig. 17 shows a cylinder casting weighing 10 cwt. —wall section ⅞ in.—and the core for a similar (but larger) casting. It is a loam-moulded casting and is run in exactly the same manner as the roller described previously. On the top, the ingates, of which there are 24—¾- by ¼-in. section—are still attached to the feeder-head part of the casting and the residue left of the runner basin. As with the roller, the core forms the runners, and head, and determines the length of casting itself, at the top. A print locates the core in the mould at the bottom. The pouring time for the cylinder shown is 25 sec. and the temperature of the metal used is not less than 1,350 deg. C. At one time, the cylinders were cast without a feed-head and on inspection a number were rejected because of "blowholes"; investigation of the so-called blowholes, however, revealed that they were in fact internal shrinkage in the flange portion. The feeder head was then applied and accommodated in the core—a method which proved both economical and successful.

FIG. 17.—*Cylinder casting (left) and a core for a similar (but larger) casting. The ring-runner is shown attached by the multiple ingates to the casting, which weighs* 10 *cwt. and is* ⅞*-in. thick.*



* Printed in the JOURNAL, April 12, p. 167.



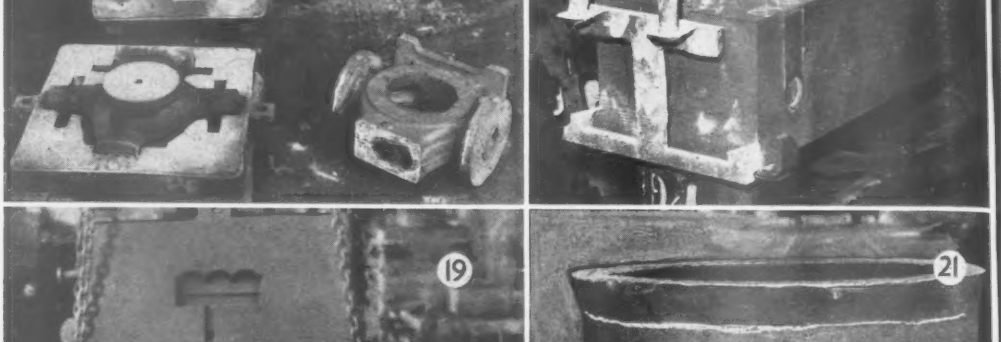


FIG. 18.—*High-speed pump casting (right) in high-duty iron and the mould and cores used for its production.* FIG. 19.—*Mould for a 4-cwt., high-duty iron casting, in which is incorporated an interlocking type of feeder head.* FIG. 20.—*Iron regulating-box casting, 45 by 16 by 12 in., with a ⅜-in. wall section. The block core used to form the running system is also shown.* FIG. 21.—*Pump-liner casting, 40-in. dia., 40-in. high, and 1¼-in. thick, for which a novel gating method was employed to obviate unsoundness below the "windows."*

High-duty-iron Castings

Fig. 18 shows a mould for and a finished high-speed pump casing in high-duty iron of the following composition: T.C. 3.0; Si 1.2; Mn 1.0; S. 0.1; P 0.2; Ni 1.0; Mo 0.6 and Cr 0.4 per cent. One downgate ¾-in. dia. was used and poured with metal at not less than 1,380 deg. C. At one time, this job was made in close-grain grey iron, but, later, the requirements of greater speeds and pressure necessitated a change to high-duty iron, although the greater density of this metal was not realized at first.

No modifications were made in the method previously used for producing these items and the result was that castings leaked in the necks near the circular flanges when on test. Sectioned castings showed internal shrinkage defects, due to the thick section in the centre drawing the metal away leaving none to feed the flanges. The addition of two feeder heads 2½- by 2-in. dia., with the channels running to the flange ½- by 2½-in. deep proved effective.

Fig. 19 illustrates an interlocking type of feeder-head incorporated into a mould for a 4-cwt. casting. It provides a perfect feed to the casting and yet is so designed as to break off easily and clean; the job illustrated was also cast in a high-duty iron.

A regulating box, measuring 3 ft. 9 in. by 16 in. by 12 in. with a wall section ⅜-in. thick and weighing 2 cwt. 1 qr. is shown in Fig. 20. This is a green-sand moulded casting, made in the standard grey-iron composition. The outside is machined all over and care has been taken therefore to eliminate gas-holes and "dirt" to ensure a perfect finish. The gating system for this casting was designed after quite a number of experimental runs and was

ultimately accommodated in a block core. Two ingates were provided at the bottom as shown, but when two downgates led metal to them there was evidence of scum being trapped in the wall section of the casting, due mainly to turbulence caused by the direct fall of metal in the downgate. Later on, the gating design illustrated was introduced; this has two downgates 1½-in. dia. from the mould top to the joint, ingates then lead to a cross bar, 3 by ⅝ in., and a further downgate 2 by ⅞ in. and cross-bar are introduced. The bottom cross-bar, which determines the speed of running and also cuts out turbulence, was 1½ by ¾ in. The ingates were then opened to 2 by ¾ in., thus eliminating any build-up of metal pressure at the ingate. These castings require pouring at high temperature and the gating system adopted has resulted in there being less than 1 per cent. scrap over a twelve-month period.

Large Pump Liner

Fig. 21 shows a large pump-liner, approximately 40-in. dia. by 40-in. high, weighing about 12 cwt. and having a wall thickness of 1¼ in.; the gating-system design here is of particular interest. Over the last few years, the wall-thickness of this casting has been increased due to the number of scrap castings which were produced. The reason for all the scrap was that after a number of different running methods had been tried, there still remained the difficulty of getting rid of scum and gas arising directly below the " windows " in the casting. Top-gating and spin-gating methods were tried and yet patches of defective metal remained always under the window panels. Ultimately the defects were remedied by the application of the ring-gate system illustrated, designed so as to allow the metal to run in through the panels on each side, thus eliminating turbulence; any scum was carried to the centre and floated to the top—avoiding entrapment by the cored panels. This was achieved by making the core divided horizontally into halves, cutting the ingates in the bottom half, and ramming the two downgates in the top half. A ring runner with the necessary ingates were cut in the top half, one downgate feeding the bottom half and the other the top ring. When pouring the mould, a stopper was first used to cover the downgate supplying the top ring, and was released when the metal in the mould rose to within six inches from the top. This was done to ensure hot metal reaching the head, which is tapered to promote proper feeding, as the metal employed for the casting had a fairly short freezing-range—its composition being approximately C, 3.0; Si, 1.6; Mn, 0.8; P 0.15; Ni, 0.2 and Cr, 0.7 per cent.

Acknowledgment

In conclusion, the Author wishes to thank his managing director, Mr. J. Phillips, for permission to present this Paper and his kindness in arranging the photography. Thanks are also due to the executives in the foundry for help in many directions.

Mr. K. C. WOODHEAD has been appointed technical service manager, fuel-oil department at the head office of Fina Petroleum Products, Limited, London, S.W.1.

Liquid-cooled Blades

One of the most important fields of development for the gas turbine lies in the operation at turbine-inlet temperatures much higher than those at present possible. Although temperatures around 4,000 deg. F., are theoretically possible, these cannot now be used because of the inability of the metal components to operate at these levels. This difficulty is overcome for the present, at a high cost in fuel consumption, by using an excess of air to dilute the combustion products before delivery to the turbine so that the temperature is sufficiently low to allow an adequate life for the various components which encounter them. To mitigate the reduction of efficiency due to this cause, heat addition, removal or exchange at various steps in the cycle is possible, but its complexity seriously detracts from the most valuable feature of the gas turbine, namely, its inherent simplicity. If materials or techniques could be devised to operate at about twice the present inlet temperature, a new era of gas-turbine development would dawn.

Probable Lines of Development

The best heat-resisting steels and alloys at present available can operate with gas temperatures of about 1,200 deg. F. in long-life machinery and the indications are that no spectacular advances are likely to be made for some time, if at all. This limitation is due to the well-known phenomenon of creep. Ceramic materials offer an alternative but they are unlikely to have much value when applied to the more arduous conditions occurring in the rotating parts. It is, therefore, generally accepted that the most promising line of development towards the high-temperature turbine is by way of cooling. In all applications of cooling, the most difficult problem is that of arranging adequate cooling for the highly stressed turbine blades. Research work on this problem has been pursued in Britain and the United States since about 1945, but as yet there has been no attempt to construct an industrial gas-turbine plant to operate at high temperatures with cooled turbine blades. The subject is discussed in a paper on heat-transfer problems of liquid-cooled gas-turbine blades, presented by Dr. H. Cohen and F. J. Bayley, to the Institution of Mechanical Engineers. The authors briefly survey the possible methods of cooling gas-turbine rotor blades, and suggest that the most attractive is the thermo-syphon system, in which a quantity of liquid is enclosed within each blade to act as a conveyor of heat to the more easily cooled root. Two experimental investigations of this system are described, the first being that in which a rotating apparatus was used to give qualitative indications of the effectiveness of the system, and the second being one using a static rig with which a more detailed study of the heat-transfer mechanism was made. Provisional suggestions are made by the authors for applying the data to the design of cooled turbines, but they emphasize the urgent need for data obtained under practical working conditions.

MORGAN CRUCIBLE COMPANY, LIMITED—Mr. C. S. Harris, a senior general manager, has been appointed a director. . Brig. G. H. Walton has also joined the board.

Industrial Use of Fuel Oil

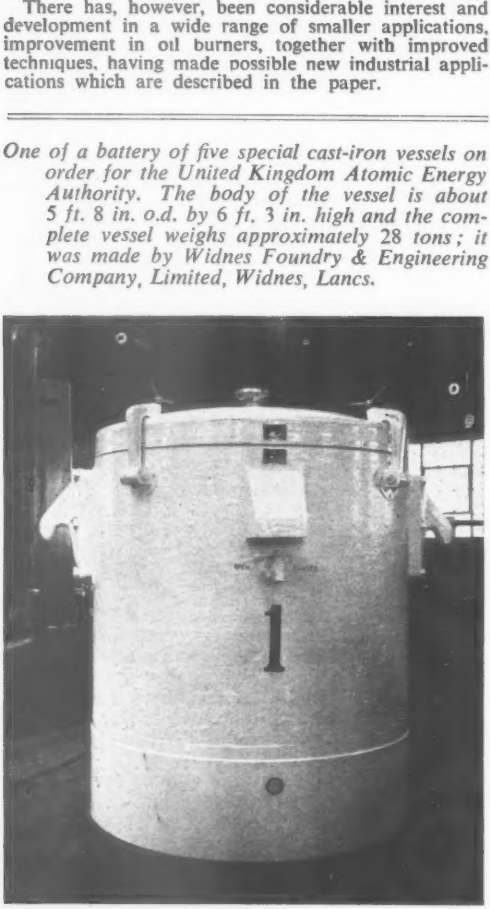
In 1938, industrial consumption of oil fuel in the United Kingdom was 1,425,700 tons; in the coal crisis year of 1947 it was 3,498,800 tons, while in 1955 it had grown to about 7,750,000 tons, excluding the refineries' own consumption of about 2,000,000 tons.

The biggest increase in the use of oil fuel for any single application has been for open-hearth steel-melting furnaces. It was not until the end of 1945 that oil fuel was first used for this purpose, but it is now being used at the rate of nearly a million tons a year. The increased use for other applications has not been so rapid and has continued on the lines of earlier development. The largest end uses are for steam raising and space heating, marine craft, gas making, reheating furnaces in steelworks, and metallurgical furnaces.

In a paper presented to the Institute of Fuel, Mr. T. Chippindale states that to meet the country's energy requirements it is expected that the industrial use of fuel oil will have to be increased to about 22,000,000 tons by 1960. The Central Electricity Authority's programme will require about 6,000,000 tons and no doubt considerable quantities will be used for gas-making.

There has, however, been considerable interest and development in a wide range of smaller applications, improvement in oil burners, together with improved techniques, having made possible new industrial applications which are described in the paper.

One of a battery of five special cast-iron vessels on order for the United Kingdom Atomic Energy Authority. The body of the vessel is about 5 ft. 8 in. o.d. by 6 ft. 3 in. high and the complete vessel weighs approximately 28 tons; it was made by Widnes Foundry & Engineering Company, Limited, Widnes, Lancs.



Railway Wagons Orders

Contracts have been placed by the British Transport Commission under the railways modernization plan for over 8,500 wagons. Orders have been placed with the following manufacturers:—Birmingham Railway Carriage & Wagon Company, Limited, 500 21-ton hopper coal wagons and 48 20-ton ballast brake vans with plough; Cambrian Wagon & Engineering Company, Limited, Cardiff, 200 20-ton ballast and sleeper wagons, and one 40-ton armour plate wagon; Cravens, Limited, Sheffield, 1,000 21-ton hopper coal wagons; Fairfield Shipbuilding & Engineering Company, Limited, Chepstow, 800 21-ton hopper coal wagons; Gloucester Railway Carriage & Wagon Company, Limited, 800 21-ton hopper coal wagons.

Head, Wrightson & Company, Limited, Thornaby-on-Tees, 800 21-ton hopper coal wagons; Hurst, Nelson & Company, Limited, Motherwell, 800 21-ton hopper coal wagons; Metropolitan-Cammell Carriage & Wagon Company, Limited, Birmingham, 450 21-ton hopper coal wagons, 100 20-ton bulk cement wagons, and 201 19-ton hopper ballast wagons; R. Y. Pickering & Company, Limited, Wishaw (Lancs), 29 45-ton flat wagons for special loads; Charles Roberts & Company, Limited, Horbury Junction, Wakefield, 1,150 21-ton hopper coal wagons; Tees Side Bridge & Engineering Works, Limited, 200 42-ton bogie bolster wagons.

The Standard Railway Wagon Company, Limited, Stockport, has received an order for 500 21-ton all-steel mineral hopper wagons, which are to be manufactured by the Lancashire & Yorkshire Wagon & Engineering Company, Limited, Heywood (Lancs). The Central Wagon Company, Limited, Wigan, is to build 1,000 16-ton all-steel mineral wagons.

Hadfields Subsidiaries Boards

More directors have been added to the boards of three manufacturing companies within the group headed by Hadfields, Limited. Formerly each company, of which Mr. Harold Humphries, managing director of the parent company, is chairman had a director in charge. The reorganized boards are as follow:—

Hadfields Steels, Limited: Mr. E. W. Colbeck (managing director), Major H. G. Freeman, Mr. A. H. Waine, Mr. J. F. Squire, and Dr. J. R. Rait. Hadfields Forgings, Limited: Mr. Waine (managing director), Mr. Colbeck, Mr. R. Lamb, Mr. G. Wood, Mr. E. H. Booth, and Mr Squire. Hadfields Foundry & Engineering Company, Limited: Major Freeman (managing director), Mr. Colbeck, Mr. F. A. Bailey, and Mr. Squire.

Fall in Unemployment

Statistics issued by the Ministry of Labour show that the number in civil employment in Great Britain at the end of February was 22,950,000, a decrease of 35,000 since the end of January. Unemployment fell by 10,000 between mid-February and mid-March, to 266,000 or 1.2 per cent. of the working population, compared with 1.3 per cent. in February and in March, 1955.

The largest falls in unemployment were in Scotland, and northern and eastern England—all areas of relatively heavy unemployment. However, in the regions of greatest labour shortage—London, the Midlands, and Yorkshire—unemployment rose.

Australian Foundry Industry

In the "Survey of Manufacturing Activity in Australia," issued by the Division of National Development, Melbourne, Australia, the following details of the foundry industry for 1955 are given:—

Iron Castings

About 70 per cent. of the output of iron castings comes from the larger repetition foundries which are "captive" or associated with larger concerns. There are over 400 iron foundries in Australia with a total employment of about 12,500.

Production

Production of iron castings has on the whole improved during the past six months, and generally since April has been at a higher level than in the preceding half year. Repetition foundries and jobbing foundries making special irons show the largest rises in production. The most marked improvements occurred in Victoria and to a lesser extent South Australia. Production in the other States has remained at about the same levels as in April, 1955. Compared with a year ago, total volume of iron castings is up about 5 per cent. and is engaging about 80 per cent. of capacity.

Individual foundries report some hesitancy in demand which they ascribe to the cumulative effects of the stricter credit policy and financial stringency generally. On the other hand, most expect that import restrictions and continuing general development will counter the adverse effects. Profit margins are still fairly narrow but are expected generally to remain stable. Most foundries regard 1955 as equally satisfactory to 1954, and expect a levelling off of demand in 1956 at about or a little less than at present.

Prices and Costs

Prices of iron castings are stable except in a few foundries which have found rises varying from one to about 7 per cent. were needed. Generally most foundries continue to contain their costs and avoid price increases, despite a rise in the price of pig-iron of 2½ per cent., a similar rise in direct labour costs and a continuing burden of overtime paid partly to retain employees, plus a high turnover of unskilled labour. Some foundries have extended minor mechanization and introduced better production techniques to counter these upward cost trends, and look to increased output to compensate for the consequent higher overhead charges.

Employment

The industry has added to its work-force by only a few per cent. during the past six months. This reflects the movement of unskilled workers rather than buoyancy of business. Labour turnover in unskilled operatives remains high in Victoria and is at lower levels elsewhere. Skilled moulders are practically unobtainable, but show little tendency to change their employment. Semi-skilled men and apprentices are scarce. The unskilled labour offering for employment is generally of poor type. A large proportion now of the non-tradesmen in constant employment in the industry are new Australians. Ample overtime up to about eight hours per week and, in some foundries production bonuses, have proved necessary to retain employees. Some instances of reduced efforts or increased absenteeism are reported due perhaps in part to current high individual weekly earnings.

Investment

After a short period of consolidation following a fairly widespread programme of re-equipment and expansion, the ironfoundry industry is commencing another growth period. A number of companies either have new developments under way or have plans for extension. Some of these involve new capacity, designed on modern lines to reduce manual effort; others less ambitious aim to increase productivity and lower costs by installing better equipment.

Non-ferrous Sand Castings

About one-third of the output of non-ferrous sand castings is made in jobbing foundries for a wide variety of engineering uses. With rapid rises in the cost of copper, some foundries are becoming more interested in aluminium, but the supply of this metal is difficult as, so far, it has all been imported. Production of ingot from the new refinery in Tasmania has commenced but supplies from this source cannot help the foundry industry for some time. Most foundries are using secondary metals as much as possible and restricting their consumption of virgin copper and aluminium for use in specification castings. There are about 500 non-ferrous sand foundries in Australia, employing over 5,500 persons.

Production

Production overall shows an upward trend in value over the past six months. The increase is of the order of 10 per cent., but when price rises, due mainly to materials costs, are taken into account, it is probable the total weight of castings produced has remained steady since April. The largest producers of plumbers' brassware and valves have increased their outputs of sand castings, in some cases at the expense of hot forgings. Smaller producers of these lines have maintained steady output. The general jobbing trade has been stable overall, with some increase in aluminium castings at the expense of copper-alloy castings.

Prices and Costs

Prices generally have increased about 5 per cent. since April except in South Australia, where price rises of about 10 per cent. have occurred. These rises have been due mainly to increases in the cost of copper. Labour costs have either been stable or have risen one or two per cent. Some foundries, in their endeavour to retain business, have elected to absorb added costs of raw materials and labour during the period April-September. Most of these express the view that any further rises will have to be passed on to customers.

Australian Foundry Industry

Steel Castings

Most steel castings are produced in batch lots or as single castings, rather than by the repetition methods which are more generally used for the manufacture of iron castings. Many medium to light steel castings, however, are made by repetition methods. They are used in a wide variety of engineering industries. They are usually made in plain carbon steels, but there is a growing demand for small castings in special steels, *e.g.* stainless steel, heat-resisting steel, etc.

Production

Most steel foundries in Australia are busy. Production during the past six months was at a high level, except in Queensland where a slight fall occurred. More castings were produced than in the preceding six months, and output for 1954-55 was about 10 per cent. higher than in the previous year. The present average capacity in use, based on shifts worked, is about 75 per cent. or a little higher, with limits of 50 and 90 per cent.

Demand

The demand for ordinary grades of steel castings varies between foundries and as between States. The speciality foundries in Victoria and New South Wales report a strong demand for stainless, heat-resistant and other special high-alloy castings, but their ability to meet this demand is restricted by shortage of nickel. This rise in demand has been specially noticeable in heat-resistant castings used in furnace construction and for heat-treatment jigs and fixtures.

During the year a reduction in ordering rate for ordinary grades has enabled delivery times to be shortened slightly, but they vary as between foundries. Deliveries are taking from two to three months from date of order. The slight decline in orders on hand is claimed to be a result of restriction of capital investment. Although the decline, if continued, may be an indication of a downward trend, the general stability of the industry has not yet been affected.

Sales are better than last year but vary from State to State and according to the types of castings. Competition has become keener in recent months. Foundries facing reduced local demand are seeking export opportunities. Prospects for sales in overseas markets are not good, owing in most cases to high manufacturing costs.*

Prices and Costs

Prices have been stable following a rise of between five per cent. and eight per cent. early in the year. Since April a few foundries have raised prices a few per cent., mainly to cover increased costs of materials. Small rises in costs which have occurred, or are expected to occur in the next few months, may soon cause other foundries to raise their prices slightly, as increased efficiency and better productivity have not compensated for rising costs of raw materials. On the other hand, competition is becoming keener and many foundries will try to absorb rising costs as much as they can.

Employment

There are over 30 steel foundries in Australia employing about 4,000 persons, which is about the April level. The busiest foundries are paying over award rates and most find overtime and bonus payments are necessary to retain their men. Skilled moulders are very scarce and semi-skilled and unskilled labour tend to drift to foundries offering best pay and working conditions. There are some labour difficulties in Victoria and South Australia, but elsewhere conditions are stable.

General Comments

Production has been steady or at higher levels, depending on locality. Generally it has been maintained by reducing outstanding orders, but delivery dates are still fairly long. The industry is worried by shortages of suitable labour and of imported raw materials (nickel and ferro-manganese) and rises in costs of materials. Future markets depend largely on the levels of public works expenditure and capital investment in industry.

* This is not confirmed by a recent inspection of an Australian tender—EDITOR.

British Aluminium Finance Plans

In order to provide approximately £7,000,000 needed for the first stages of its Canadian aluminium smelter, the British Aluminium Company, Limited, has arranged for UK bank loans of £3,000,000—probably to be funded during the three to five years period of accommodation by loan capital. To raise the balance, the company proposes a rights issue of approximately 2,000,000 £1 ordinary shares. Authorized capital is to be increased by 5,000,000 £1 ordinary shares, and borrowing powers extended.

The Canadian project is planned for development in four stages, each of 40,000 tons per annum capacity. The first stage is due for completion by spring, 1958, the second by autumn, 1959, at an estimated cost of $72,000,000, and the third and fourth stages for 1961-65 at $57,000,000, a total of $129,000,000. Production is hoped to commence during the winter of 1957-58, and the major part of output should be absorbed by the group's needs, it is stated.

Engineering Centre's President

Four years of satisfactory results is the achievement of Mr. Christopher Grazebrook who recently retired from the presidency of the Birmingham Exchange and Engineering Centre. The conception of the centre as a permanent shop window for Britain's engineering industry was largely Mr. Grazebrook's. As the head of a Black Country iron foundry, he saw clearly that changing times had rendered the old Birmingham Exchange obsolete in its traditional role as the centre of the Midland iron trade. By linking the Exchange up with engineering, he ensured it a new lease of life. In its second year the new centre is well established, with 250 exhibitors and 50,000 visitors annually.

So that he could guide the new venture in its early days, Mr. Grazebrook remained as president for a year longer than the usual span. He is succeeded by Mr. Victor Brenner, a leading figure in the metal trade, and a member of the Government's scrap metals advisory committee.

Extensions at Parsons' Heaton Works

During 1955, C. A. Parsons & Company, Limited, Heaton Works, Newcastle-upon-Tyne, received orders for turbo-generating plant totalling 1,653,000 kw. They included six 120,000-kw sets, four 100,000-kw sets, two 60,000-kw sets and 19 machines for outputs of from 12,500 to 30,000 kw. Some machines are for power stations in this country and others for export to Australia, South Africa, Iraq, and Venezuela. The orders for the larger machines brought the total number of sets constructed or on order to nine 120,000-kw, 10 100,000-kw, and 45 60,000-kw turbo generators.

To facilitate the construction, erection, and testing of large machines a new shop with a floor area of 26,100 sq. ft. has recently been completed at Heaton.

A review of the campany's activities in 1955 recalls that the air-bleed gas-turbine installed in the National Gas Turbine Establishment at Pyestock was first started early in 1955, and has since been extensively tested. This machine, which is the largest of its type in the country, delivers up to 25 lb. of air per sec. at any pressure up to a maximum of 45 lb. per sq. in., for use in the various aerodynamic and combustion test rigs at the establishment. Here, also, the erection of a 10,000 kw gas turbine is nearing completion, designed to operate on fuel oil and generate electric power.

The erection of the 15,000-kw gas turbine supplied to the Central Electricity Authority has been completed at Dunston "A" power station, and the set was commissioned in November. An 1,800-h.p. coal-fired locomotive gas turbine is now being erected at Heaton, and tests on this prototype are about to begin.

During 1955 a fourth Parsons turbo-blower was put into commission at the Seraphim plant of the Appleby-Frodingham Steel Company. These machines are each of 80,000 cub. ft. per min. capacity, the air pressure being 30 lb. per sq. in. A fifth Parsons turbo-blower has recently been ordered by the same company. This machine, it is claimed, will be the largest turbo-blower in the world, its duty being 160,000 cub. ft. per min. at 35 lb. per sq. in.

A fourth Parsons turbo-blower was commissioned at the works of the Consett Iron Company, Limited, the capacity of this machine being 45,000 cub. ft. per min. at 30 lb. per sq. in. pressure. At the steelworks of John Summers & Sons, Shotton, a third unit delivering 80,000 cub. ft. of air at the same pressure was also completed.

Recent extensions to the blast-furnace plant of the Stanton Ironworks Company, Limited, include two turbo-blowers each of 40,000 cub. ft. per min. capacity at 15 lb. per sq. in. pressure and a 6,000-kw turbo-generator.

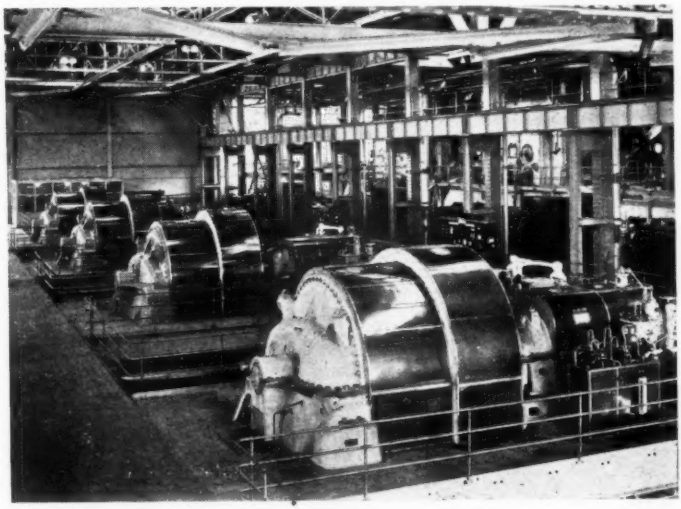


FIG. 1.—*Four Parsons turbo-blowers installed at the works of the Appleby-Frodingham Steel Company.*

New Catalogues

Idlers. A catalogue received from Fraser-Chalmers Engineering Works (Erith, Kent), of the General Electric Company, Limited, is devoted to illustrating and describing heavy-duty idlers such as are used beneath band conveyors to induce troughing. Quite a number of different types are shown.

Welding. Quasi-Arc Company, Limited, Bilston, Staffs, have submitted a 12-page well-illustrated brochure covering Sigma welding which uses the inert-gas-shielded, metallic-arc process. It was primarily developed for the welding of aluminium and stainless steel, but is used effectively for the reclamation of castings, as the wire used can be of the same material as the casting to be treated. The catalogue is available to readers on writing to Bilston.

Refractory Concrete for Foundry Floors. Lafarge Aluminous Cement Company, Limited, 73, Brook Street, London, W.1, has devoted an eight-page leaflet (SM 1.56.L.B.) to explaining the advantages to be gained from the use of refractory concrete instead of the ordinary material for the making of foundry floors and gangways. It contains an illuminating photograph of a floor made up of half ordinary and half refractory concrete over which molten metal has flowed. The former was ruined whilst the latter was untouched. This interesting booklet is available to readers on writing to Brook Street. A second pamphlet has also been received which deals with monolithic underground flues in refractory concrete.

ROLLS ROYCE, LIMITED, Derby, has undertaken the photographing of the 480 handwritten pages of the "Book of Remembrance" in York Minster, which contains the names of 18,000 airmen who were killed in the war. Each page is to be photographed separately and it is intended to send the appropriate photographed pages to the next-of-kin of those named in the book.

American Foundrymen's Society

Annual Congress in Atlantic City, May 3 to 9

The 60th Congress of the American Foundrymen's Society is to be held from May 3 to 9 at Atlantic City, and with it is to be associated an exhibition of foundry plant and raw material. On the afternoon of the opening day, there are to be four simultaneous sessions covering grey iron, malleable, sand, and brass and bronze. Outstanding titles amongst papers to be presented are "Service Life of Iron Castings can be Affected by their Thermal Conductivity," and "Cracking and Life of Ingot Moulds." The latter is from France, and is written by Mr. Duflot of that nation's iron-steel research association. In the non-ferrous session, there is listed a paper on fluxing by Mr. G. Neu and Mr. Gotheridge of the Foundry Services Group, and one on "Gas Porosity in Oxygen-free Copper Castings," from members of the staffs of three scholastic establishments.

During Friday (May 4), no fewer than 17 papers are to be presented. Of these three are from Germany covering hot-blast cupolas (two) and mains-frequency coreless induction-furnaces. A paper of interest to malleable founders is one where a combination of oil and powdered fuel is used. There are papers on epoxy resins for patternmaking; "Does Sand Testing Give us the Facts?"; and "Centrifugal Casting of Unusual Shapes in Non-ferrous Alloys." On the Saturday, there are a further 17 papers, and amongst the subjects covered are basic cupola refractories; the effects of sodium modification on the tensile properties of aluminium/silicon/magnesium alloys; the preliminary evaluation of "fluid coke" as a moulding material; resin-coated sand; mould blowing; high-pressure moulding and shell moulding. On the Monday there are to be eight sessions each having either two or three lectures. The official Institute of British Foundrymen exchange paper is to be by Dr. D. V. Atterton, who is dealing with the CO_2 Process. There is a second paper on this subject, but dealing with cores, by Mr. F. M. Scaggs, who is attached to an American steel foundry.

On Tuesday, May 8, two sessions are being devoted to noise control—a subject coming more and more into prominence. Other sessions are devoted to heat transfer; industrial engineering; patterns—with a paper on metal pattern equipment; grey iron—including one by Mr. W. G. Tonks, of the British Cast Iron Research Association on subcutaneous blowholes related to manganese-sulphide segregation. In the afternoon of that day there is a "fundamental papers" session—with one on a new method for measuring fluidity; and a "steel" session—here there is a paper on inorganic binders in connection with shell moulding and another on metallography.

Notable amongst the papers to be given on the last day is one with the intriguing title, which is difficult to interpret here, of "What's New with Snotters?" Other papers which sound interesting are "Blow-hot Press Automatic Shell-moulding Machine," and "Casting Tolerances as Affected by Automation in the Machine Shop," this is given by Mr. E. L. Buchman, of the Ford Motor Company, Berea, Ohio.

The whole programme is interspersed with "round-table" lunches, a banquet, and several sectional dinners.

W. J. HOOKER, LIMITED, Finchley Road, London, N.W.3, announce that some reduction in the price of the various grades of Sterling Die Slick and Plunger Slick is now possible.

UK Aid for Indian Steel Project

Financial aid has been promised from the United Kingdom for the Indian Government's project to establish a third new steel plant in India. The first two plants are being established by German and Russian interests, while the third, at Durgapur, in Bengal, is being set up in consequence of proposals from a consortium of British steel-plant manufacturers.

Of the £50,000,000 of foreign exchange needed for the plant, the UK Government will arrange for credits totalling £26,500,000. A further £11,500,000 is to be raised by the consortium through banking channels with normal Export Credits Guarantee Department cover. It has been announced that Lazard Bros. & Company, Limited, has arranged credit facilities for the latter sum offered by a group of British banks.

It was announced in the House of Commons by the President of the Board of Trade, Mr. Peter Thorneycroft, that broad agreement had been reached between the Indian Government and the consortium—the Indian Steelworks Construction Company, Limited—for the erection of the plant and final specifications and tenders were to be submitted by May. It was hoped that the contract would be signed by July.

Meanwhile, at Jamshedpur a £2,250,000 steel-tube plant has been formally opened. The project has been fostered by the Tata Iron & Steel Company, Limited, and Stewarts and Lloyds, Limited; the plant is capable of producing 12,000 miles of steel tubing a year. Another project by the two companies—a £1,500,000 mill for bicycle tubes and locomotive boilers—is now under construction at Jamshedpur. A third scheme, for the manufacture of seamless tubes, is awaiting Government sanction.

West German reports indicate that Demag, the engineering concern, and Kaiser, the United States consulting engineers, have jointly been awarded a contract worth $5,000,000 for the construction of a rolling mill for Tata at Jamshedpur. A reversible 32-in. rolling mill is planned capable of handling three rolled blocks of up to 9 tons. Complementary plant includes a billeting and semi-flat mill.

India and the Soviet Union have signed a final agreement for the construction of the Russian plant at Bhilai. The original plan for a plant with two blast furnaces has now been expanded to three furnaces, giving the plant a total output of 1,000,000 tons of ingots and 300,000 tons of pig-iron. With slight additions, the plant capacity can be extended at any time to 1,300,000 tons of ingots. The cost of the equipment and construction will be £82,500,000, of which the equipment to be supplied by Russia will cost about half.

Atomic Engineering Group

A new group of companies—under the title Vickers Nuclear Engineering, Limited—to pursue engineering development in the atomic field has been formed by Vickers, Limited, Rolls-Royce, Limited, and Foster Wheeler, Limited. The first task will be the application of nuclear energy to marine propulsion.

The object of the formation of Vickers Nuclear Engineering is the control of policy within the Vickers group of engineering development in the atomic field.

The first directors are:—Sir Ronald Weeks, chairman of Vickers; Lord Hives, chairman of Rolls-Royce; Major-General C. A. L. Dunphie, chairman of Vickers-Armstrongs, and Mr. Geoffrey H. Hopewell, managing director of Foster Wheeler. Rear-Admiral L. E. Rebbeck has joined the staff of the Vickers group, and will be in executive charge of the project.

Equipment and Supplies

Oil and Water Separator

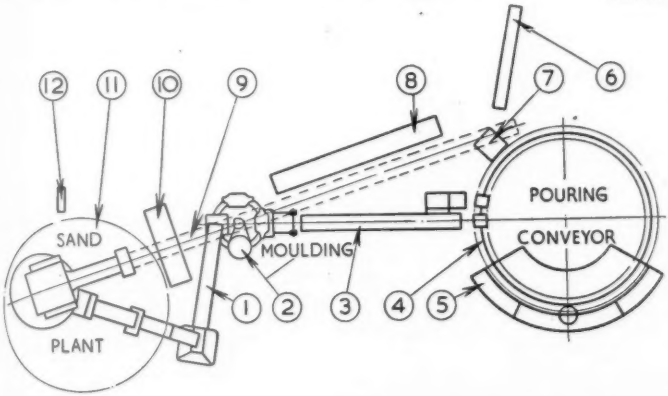
Alfred Bullows & Sons, Limited, Long Street, Walsall, Staffs, have recently produced a separator which is claimed completely to remove oil from air lines at temperatures up to 150 deg. C., and water from lines where condensation has taken place. The separator consists of banks of long-fibre-felt pads which become wetted by the passage of contaminated air and cause the very fine particles of oil and water to coagulate. This increases the particle size so that the oil and water are easily separated from the air stream. The filter is self-cleaning and discharges collected oil and water through an automatic valve. The unit is available in two sizes—the E.200 and the E.250 with capacities of 20 cub. ft. per min. at 100 lb. per sq. in. and 65 cub. ft. per min. at 100 lb. per sq. in. respectively.

Automatic Moulding System

A complete moulding plant mainly intended for the production of small repetitive castings, known as the Hallsworth system, has been developed by Rubery, Owen & Company, Limited, Darlaston, Staffs. It is claimed that the plant, shown in Figs. 1 and 2, includes every piece of equipment necessary to lay out a completely mechanized foundry using vertically-poured boxes 12 by 9 by 5 in. The basic feature of the plant is the four-station, self-indexing Hallsworth moulding machine performing the operations of sand metering, edge tucking, squeezing, removal of surplus sand, pattern-stripping and mould removal. Closing of moulds, together with any necessary coring, is carried out by hand on the conveyor track, and the complete mould is loaded into the rotary mould-conveyor unit which automatically clamps and tilts the mould, delivering it to the pouring station at the correct angle for casting. Shaking-out of the cast mould is done on a vibrating grid and used sand is returned underground to the sand-treatment unit, where it is automatically re-conditioned in a sequence controlled cycle before re-delivery to the moulding machine.

A fundamental of the plant is the relatively small box-size accommodated; it facilitates automatic handling, reduces operator fatigue and increases the output per man of castings produced. This, together with vertical pouring, is claimed to produce high yield. The system is flexible and it is said to be possible to instal it in foundries already possessing equipment which could be substituted for part of the system. Full technical advice is available and the foundry-equipment division of the firm can assist in recommending suitable ancillary equipment. The service extends from the supply of the spare moulding boxes to the supply of complete buildings in which to instal the plant.

FIG. 1.—*General arrangement of the Hallsworth automatic moulding syestem.*



Key: (1) Hopper and sand-feed conveyor; (2) automatic moulding-machine, including scraper and take-off; (3) coring conveyor; (4) mould conveyor; (5) pouring mechanism; (6) casting delivery conveyor; (7) shake-out; (8) box-return conveyor; (9) sand-return conveyor (underground); (10) magnetic separator; (11) sand conditioning plant (including bucket elevators, rotary screen, mixing mill, water-meter and sprays, disintegrator mill, elevator, feed conveyor, storage and batch hoppers, mill discharge-hopper (automatic sequence controlled)); and (12) control panel.

A model of the system described is being exhibited on the firm's stand (No. D616/717) at the Castle Bromwich section of the British Industries Fair (closes May 4).

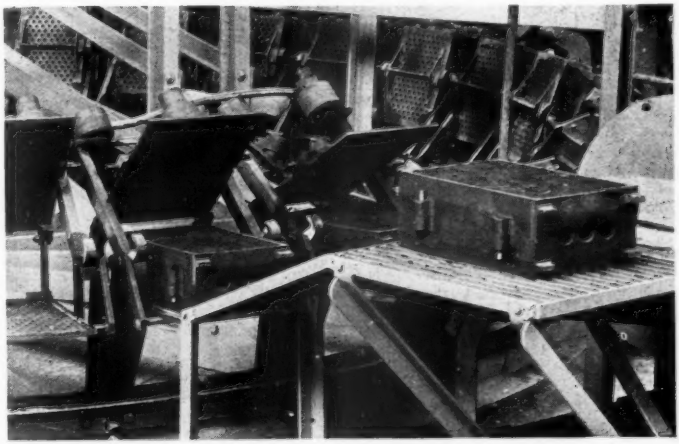


FIG. 2.—*View of mould loading station showing closed mould and loaded pallets. Note the locating lugs on the boxes and the arrangement for vertical pouring.*

[Courtesy, Platt Malleable Casting Company, Limited.

Equipment and Supplies

Chisel Sleeve for Dust Control

A new type of dust-controlling sleeve easily fitted for pneumatic chipping hammers has been specially developed for foundry requirements by the Dustuctor Company, Limited, of Hayle, Cornwall. It is based on the low-volume high-velocity system of dust-collection at source which was pioneered by the company. In fettling operations, respirable dust which is most dangerous in the invisible size range of 0.5 to 5 microns, is injurious to the health of foundrymen.

The Dustuctor chisel-sleeve controls and collects the dust created at the chisel edge when "fettling" or cleaning and descaling castings, or similar operations. It makes its appearance in a year when new foundry regulations under the Factory Acts make effective means of dust control in the foundry compulsory. Dust control for such tools with their arduous life and exacting requirements as regards flexibility and ease of operation has proved a difficult problem, and the new sleeve is the result of much research to assist the process of "immunizing" the foundry worker against pneumoconiosis and similar diseases caused by the dust. The new sleeve is simple to fit and its shock-absorbing characteristics assist the operator. It does not reduce efficiency, and the air consumption is small.

Dust collection takes place at about an inch from the chisel point, the dust being drawn through slots on the inner surface of the sleeve, forming ducts with the surface of the chisel itself, from which dust is led to an integral branch at the top of the sleeve and thence to the collecting apparatus. Positioning is by means of an annular ring ground in the chisel, which coincides with a ring in the sleeve itself. As the chisel shortens during its life, the sleeve can be cut back, and is designed to be kept about 1 in. from the cutting edge.

A vacuum of 5 in. of mercury is required, at which

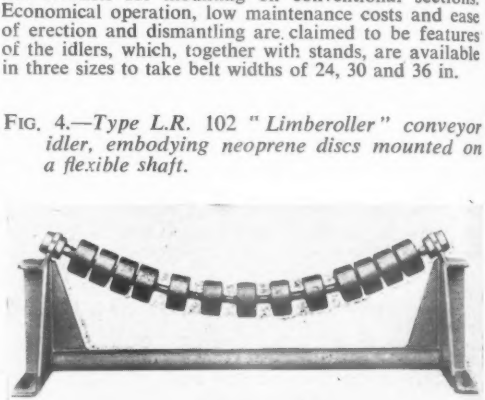
FIG. 3.—*Chisel sleeve for dust control.*

depression the sleeve passes 6.5 cub. ft. of air per minute. The sleeve is designed for use with the company's collector and filter units, which can be used with a venturi-type of suction producing apparatus known as an eductor, or with a multi-stage exhaust fan or rotary exhauster. The collector filter unit, which is supplied in two patterns, can serve up to four chisels when using the pneumatic eductor; with an electrically driven vacuum source up to ten chisels can be served.

Conveyor Idler

A flexible-belt-convevor idler—known as the Limberoller (Fig. 4)—of American design, is now being manufactured in Great Britain by Joy-Sullivan, Limited, Greenock, Scotland. The idler consists of a series of pressure-moulded neoprene discs moulded to a neoprene-sheathed flexible steel cable. This cable is freely suspended from two cadmium-plated precision ball-bearings to give support which conforms to a load on the belt. The bearings are sealed and charged with grease which is claimed to ensure trouble-free running. The complete idler roller and bearing assembly can be changed without interrupting the flow of material, as it is said to be unnecessary to stop the belt for this purpose. Constant flexing reduces any tendency for material to build up on the belt. Two styles of stand are available; the L.R.113 is 13½ in. or 16 in. high and has a tripod base; the type L.R.102 has brackets for mounting on conventional sections. Economical operation, low maintenance costs and ease of erection and dismantling are claimed to be features of the idlers, which, together with stands, are available in three sizes to take belt widths of 24, 30 and 36 in.

FIG. 4.—*Type L.R. 102 "Limberoller" conveyor idler, embodying neoprene discs mounted on a flexible shaft.*



Electrically-heated Screens

In a statement made at Paisley recently, Mr. L. Landon Goodman, B.SC., representing the British Electrical Development Association, outlined a number of new methods of processing aided by electricity. Amongst these, he mentioned that the electrical heating of screens for sieving damp sand, clay, etc., had in some instances permitted an increase in throughput of 100 per cent. Screen heating, he said, has been found to be most satisfactory when carried out by passing a low-voltage electric current through the mesh wires. The current is supplied from a tapped transformer which gives flexibility to meet variations in materials, screens, moisture contents and temperatures. Electrical heating of screens does away with screen blinding, thus brushing and hammering are eliminated, leading to a longer life of the screen.

HEADLAMP ENGINEERING DEVELOPMENTS, LIMITED, 164-168, Westminster Bridge Road, London, S.E.1, have been appointed agents for the sale of the Thermophil electronic thermometer. It is of the probe type, weighs about 2 lb., and is equally applicable for the measurement of solids or liquids. Without recharging the batteries it is claimed that 1½-million tests can be made.

YALE & TOWNE MANUFACTURING COMPANY, British Materials Handling Division, Wednesfield, Wolverhampton, announce a modification to their electric fork-lift truck, whereby it is fitted with two pairs of forks, to enable different sizes of pallets to be handled without the need for an adjustable carriage. A second development is in the production of the Worksaver electric low-lift platform model for furnace use. Either of two models "Standard" and "Stubby" are now available with a large steel baffle-plate fitted in front of the battery compartment.

Shear-frame Casting for New Lackenby Rolling Mill

Measuring approximately 26 ft. in length, 12 ft. in width and 8 ft. in depth, one of the most complicated heavy steel castings ever attempted in Great Britain has recently been delivered by English Steel Castings Corporation, Limited, Sheffield, a subsidiary of English Steel Corporation, Limited, to the Darnall Works of Davy & United Engineering Company, Limited, Sheffield. This casting is a 142-ton "C" frame for the 1,350-ton shear which Davy-United is building for Dorman Long as part of a contract for a new blooming and slabbing mill plant at Lackenby. Due to its complexity of varying wall thicknesses and shapes, and despite the many technical problems involved in making this particular casting, it was decided that a casting made in one piece was the only possible method of manufacture, since neither a fabricated structure nor two or three separate castings could be designed, which would meet the arduous service requirements of a shear.

With its very complicated arrangement of 80 cores, the mould was made in a pit measuring 35 ft. in length, 17 ft. in width and 10 ft. in depth, these preliminaries accounting for 1,240 man-hrs. in moulding and closing, and 600 man-hrs. in core-making and fitting. To dry out the moulds took another four weeks, with the numerous portable drying stoves which burnt 30 tons of coke between them. The casting operation took half an hour, three ladles simultaneously pouring a total of 198 tons of molten steel into the mould. Later, over a period of several hours, a further 25 tons of liquid steel were added to the 21 feeder-heads.

FIG. 1.—*Coring-up moulds prior to casting 142-ton shear frame for the Lackenby Rolling Mill.*

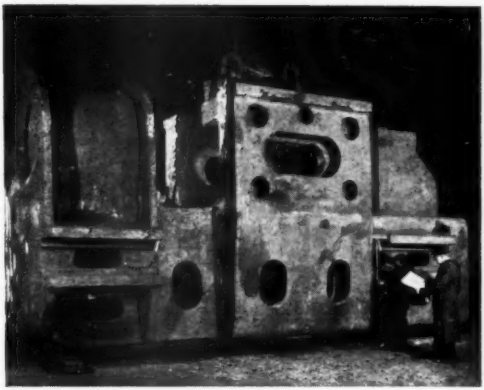


FIG. 2.—*View of the shear-frame casting after dressing.*

Practically the whole of the foundry's steel-making resources were required for the pouring operation, and for the bulk of the steel three open-hearth furnaces had to be tapped simultaneously. The casting was left in the mould for four weeks to cool, after which hydraulic jacks and overhead cranes were used to lift it from the pit before fettling and heat-treatment. A further casting of similar design is to be supplied to Davy-United later in the year.

FBI Warning on State Expenditure

The view that industry was entitled to look to the Government for a positive lead in the country's fight against inflation was expressed by Sir Graham Hayman, president of the Federation of British Industries, at the annual general meeting of the federation in London. Sir Graham, who was later re-elected president, said that the recent White Paper on the economic implications of full employment contained much valuable information and guidance, but it was profoundly disappointing that the Government did not give it the hallmark of leadership by declaring its own determination to retrench. Industry was entitled to expect the Government to practise what it preached and to prune the many extravagant and wasteful channels of administrative and capital expenditure.

The value of the pound and its purchasing power in terms of commodities must be stabilized, the surplus in our balance of payments restored, and physical shortages relieved, continued the FBI president. There were good prospects of achieving these objects, but what was ultimately of the greatest importance was "the permanent establishment of a proper pattern of balance in the use of the country's total productive resources." It was by no means evident that the country, on the whole, was alive to the realities of the position. Emphasizing the importance of an enhanced level of investment, he said that the federation had impressed upon the Government the necessity for lifting the present restriction at the earliest possible moment.

Company News

RANSOMES, SIMS & JEFFERIES, LIMITED, agricultural and general engineers, of Ipswich—CIC consent has been obtained for an issue of 500,000 £1 ordinary shares by way of capitalization of reserves. The new shares will be distributed on the basis of one for each £4 nominal amount of ordinary stock already held.

CRAVEN BROS. (MANCHESTER), LIMITED, machine-tool makers—Maintenance of the company's final dividend at 12½ per cent. makes a total of 17½ per cent. on £700,000 ordinary stock as increased last May by a rights issue of two for five. The same total was paid for 1954 on £500,000. After charging £135,000 for taxation, against £133,000, net profit for 1955 is £127,842, against £126,551.

DARWINS, LIMITED—The board announces the purchase of the entire issued capital of J. Stead & Company, Limited, makers of small tools and specialized wire products, of Sheffield. The purchase, it is stated, has been financed by Darwins out of its own resources. The services of Mr. J. A. Stead, whose father founded J. Stead & Company, will be available to Darwins in an advisory capacity.

ENGLISH STEEL CORPORATION, LIMITED—A final dividend of 7 per cent. is recommended on the £6,000,000 "A" ordinary and £2,000,000 "B" ordinary shares, payable May 30, making 10 per cent. for 1955. The "A" are held by Vickers, Limited, and the "B" ordinary by Cammell Laird & Company, Limited. A 5 per cent. dividend was paid a year ago. The payments for 1955 will absorb £460,000 net (£220,000).

LANCASHIRE DYNAMO HOLDINGS, LIMITED—A final dividend of 7 per cent., making 11 per cent. for the year 1955 on £1,801,179 ordinary capital as increased by a 50 per cent. scrip issue and by an acquisition issue, is recommended by the board. On the former capital of £1,168,664 the total dividend was 15 per cent., of which 11 per cent. was the final. Group net profit, before tax, amounts to £584,554 (£540,262).

BUTTERLEY COMPANY, LIMITED—The company is paying a capital distribution of 8d. per 2s. 6d. share making with the 4d. per share paid last November in lieu of an interim, 1s. per share, or 40 per cent., not subject to tax, for 1955 on the £225,000 ordinary capital. For the previous year an interim dividend of 24 per cent., less tax, was followed by a capital distribution of 8d. per share, not subject to tax, in lieu of a final.

PULSOMETER ENGINEERING COMPANY, LIMITED—A second interim ordinary dividend of 20 per cent. is declared by the company in respect of the year 1955, which follows an interim of 5 per cent. paid in November last. Group trading profits, before tax, were at a record level of £341,552, against £291,696 in 1954. Taxation absorbs £173,948, against £153,708. The directors report that the order-book is now the largest in the company's history, and that plant extensions are under way.

WOLF ELECTRIC TOOLS (HOLDINGS), LIMITED—With group fixed assets almost doubled at £317,064, the board reports a year of unexampled activity. A new factory at Ealing has been purchased and equipped and is now in full operation making component parts for "Wolf Cub" equipment. A factory at Slough has been occupied and enlarged and, in addition, declares Mr. H. Richards, the chairman, a further modern factory in west London has been purchased to house the service department.

TELEGRAPH CONSTRUCTION & MAINTENANCE COMPANY, LIMITED—The company is maintaining its final dividend at 3¾ per cent., plus a 1 per cent. bonus, on the £2,974,596 ordinary capital as increased by a rights issue and an issue to employees. An interim of 3¾ per cent., and the previous year's similar 8½ per cent. total were on £1,954,092. Mr. J. N. Dean, chairman, reports a further very substantial increase in turnover, resulting in the group trading surplus increasing from £465,036—which included £30,000 unrequired provision credit—to £726,359 in 1955.

GENERAL REFRACTORIES, LIMITED—The offer to ordinary shareholders of 420,000 ordinary 10s. shares at 21s. each resulted in applications for 678,732 shares. Rights were exercised for 384,142 shares. After giving special consideration to applications from employees, allotment of excess shares is being made in full in the case of shareholders' applications up to 10 shares. Remaining applications are allotted as follow:—Applications for 11-25, 10 shares; 26-100, 25; 101-500, 50; 501-2,000, 100; over 2,000, 200. Where applications have been out of proportion to existing holdings, smaller allotments have been made. Renounceable allotment letters for excess shares were posted last Saturday.

VICKERS, LIMITED—A final dividend of 7½ per cent. makes a 10 per cent. total for 1955 on an ordinary capital of £29,227,244, absorbing £1,680,567. For the previous year a 2½ per cent. interim on £24,630,968 and a 6 per cent. final on £27,709,839 as increased by a rights issue, required £1,294,666. Subsequently the acquisition of just over 1,000,000 10s. shares in Powers-Samas Accounting Machines, Limited, raised the ordinary capital to its present level. After tax and outside interests, the net group profit expanded sharply from £3,307,427 to £5,597,696. The 1954 comparative figures include profits of the subsidiaries, the English Steel Corporation, Limited, and Oldings (Hatfield), Limited, from June 21 and April 1, respectively.

WILMOT-BREEDEN (HOLDINGS), LIMITED, automobile component makers, of Birmingham—The issue to ordinary shareholders of 4,200,000 5s. ordinary shares at par resulted in applications for a total of 5,213,289 shares. Rights were exercised for 4,142,643 shares (equivalent to over 98½ per cent. of the total), which have been allotted in full. For the 57,357 excess shares, applications totalled 1,070,646 shares. Allotments have therefore necessarily been very small. A proposed scrip issue will capitalize £1,050,000 by a distribution of one new ordinary share for every two held after the rights issue, raising the capital thereby to £4,110,000. The new ordinary shares will not participate in the final dividend of 11 per cent. (making a total of 17 per cent.) for the year 1955, which will be recommended by the directors at the annual meeting in June.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

FORMOSA, May 9—Cast-iron pipes, reinforcing steel, lead pigs, and lead wool, for the Central Trust of China, Purchasing Department, Taiwan. (ESB/9462/56.)

FORMOSA, May 4—Insulators, jacks, compressors, clampsticks, and steel angle, for the Central Trust of China. (ESB/5844/56.)

FORMOSA, May 17—Hoists, rock-drilling equipment, rock-bolting materials, hose, and hose couplings, for the Central Trust of China, Purchasing Department, Taiwan. (ESB/9467/56.)

FORMOSA, May 9—Equipment for water supply system, for the Central Trust of China, Purchasing Department, Taiwan. (ESB/9461/56.)

Notes from the Branches

East Anglia

The considerable interest shown in the CO_2 Process at meetings in all parts of Great Britain was well maintained at the February meeting of the East Anglian section of the London branch of the Institute of British Foundrymen, when 42 members attended to hear Mr. Tipper's paper* and film on this subject.

MR. V. W. CHILD opened the discussion by referring to core-breakdown difficulties which were still being encountered and also added that the Process had not proved to have the same advantages in mechanized foundries as were experienced in jobbing foundries.

MR. TIPPER replied that satisfactory breakdown was secured by suitable additions to the silicate and he assured those present that trouble of that sort had been eliminated, except where a relatively thin section of sand was surrounded by molten metal as in the case of a jacket core. Thin-section castings presented no difficulty, as the core did not reach the temperature at which fusion of the bond occurred. The same applied to metals cast at temperatures below about 1,000 deg. C. Regarding mechanized foundries, compared with green-sand moulding, the Process was not so economical; and price was often a major consideration. Where a cast product already had a ready market and there were no production "bottlenecks," then the case for adoption of the CO_2 Process was not so favourable.

MR. LOCK asked what was the recommended "green" bond for moulding by the Process.

MR. TIPPER said that the normal backing sand used should have a strength of 7 to 8 lb. per sq. in., and the CO_2-type facing sand a strength of about 3 lb. per sq. in

MR. LOCK also mentioned that with a CO_2-hardened core a better surface finish was obtained after standing. In what way or how did this result?

MR. TIPPER replied that it was the effect of air drying on the bond.

Non-ferrous Work

MR. BERRY referred to the casting of manganese-bronze, phosphor- and aluminium-bronzes, and asked (*a*) whether the water content in CO_2 cores would tend to cause blowholes; (*b*) was phosphor-bronze very "searching" with this Process; and (*c*) could the Process be used for long, cylindrical cores, say 2 ft. 6 in. long by 1 in dia.

MR. TIPPER replied that there was a likelihood of metal/mould reaction causing gas porosity in such bronzes; phosphor-bronze was just as "searching" as in normal practice and so a protective dressing was recommended for both CO_2-type mould and cores; long, cylindrical cores would be difficult to make in CO_2 sand.

MR. DOWNING asked whether any addition was recommended to increase the bench "life" of the sand and could the sand be freshened or revived after standing.

MR. TIPPER replied that the CO_2 sand was best protected from the atmosphere by using a damp sack or similar means. Sand which had dried out on the bench could be reconditioned, however, by further binder additions, or by adding small proportions of this sand to subsequent mixes.

MR. MAYTHAM asked what proportions of pitch would be used in the sand in relation to coal-dust quantities, and the reply was that ½ per cent. pitch was equivalent to 1-1½ per cent. coal-dust. Use of higher CO_2-bond additions tended to give a dry, friable sand and might require a small water addition to keep the sand moist.

MR. PECK asked what was the correct procedure for repairing a CO_2 core.

MR. TIPPER said that the broken surface of the core should be moistened, or treated with a core adhesive, then repaired with new sand and the patch hardened off with CO_2. When preparing a large mould by the CO_2 Process, the best technique was to partially gas the mould, draw the pattern, finish off where necessary by hand, and then finish gassing.

MR. CARRICK said that the secret appeared to be in gassing just sufficiently; many troubles arose from overgassing.

MR. TIPPER confirmed this view and said it was better to under-gas than over-gas, provided the surface of core was gassed sufficiently to permit safe handling. He added that a CO_2 core was best left two or three hours before use, to increase its strength.

Health Hazards

A MEMBER asked about possible health hazards of introducing the CO_2 Process into a foundry.

MR. TIPPER gave the following answer. Dealing first with dermatitis, he said the CO_2-Process sand was mildly alkaline, whilst the binders themselves could be fairly strongly alkaline. Operators with sensitive skins might notice this, although only one case of dermatitis had so far come to his notice, and this had not been confirmed. The solution to such trouble, as with the handling of any chemical substance, was personal cleanliness. With regard to silicosis, since this disease was slow in development, it would be a long time before anyone could give a positive answer as to whether there was any risk involved. The CO_2 Process introduces a new form of silica into the materials being used in foundries, and the medical officers attached to the Factory Inspectorate were naturally interested in the matter, and seeking information from suppliers and users. Taking a practical view, it was his own experience that CO_2-Process sand at the knock-out gave rise to less dust than normal dry sand and certainly less lachrymatory fume than oil sand. Finally, dealing with fumes, all baking fumes were of course avoided in the CO_2 Process. As he had already mentioned, the fumes from knocked-out moulds were certainly less unpleasant than from oil-sand cores, although additions of pitch and coal dust did give rise to copious smoke on casting; with heavy-section castings, this would ignite at the vents.

Newcastle-upon-Tyne

As part of the arrangements of the Newcastle-upon-Tyne branch there is no doubt about the popularity of works visits. The most recent visit of this kind was to the Crown works of Steels Engineering Products, Limited, Sunderland, of which a large number of members took advantage.

At these works production is concentrated on mechanical-handling equipment, mobile cranes, electric hoists, and agricultural implements. The capacity of the mobile cranes is from one to 40 tons and several were shown in action. In addition to the administrative and drawing offices, the buildings include a foundry, an extensive building housing the machine shop, a sheet-metal and welding shop, and mobile-crane assembly shop. Adjoining is another large building housing the plant for making the agricultural equipment for use with tractors.

* Progress of the CO_2 Process in British Foundries," printed in the JOURNAL, February 2.

Notes from the Branches

Foundry

For the relatively small output of 60 to 80 tons of castings a month, the foundry is large and lofty. The major part is allocated to ironfounding and the main castings produced are balance weights for the mobile cranes; these are cast in skin-dried moulds. Some non-ferrous castings are made in one section of the foundry, and there is also a part set aside for making all cores necessary. Two cupolas are installed, each of 4 tons per hour capacity, operating alternately. A very large sand-preparation plant is installed, the prepared sand being carried by conveyor belt to moulding stations where two impeller-type ramming machines operate. For melting non-ferrous metals, a crucible-type tilting furnace is installed. In this section it was noted that experiments are in progress with the CO_2 Process and also with the production of centrifugally-cast bronze castings, and the visitors were able to contribute comment from their own experience which would probably advance these experiments.

All the other departments of the works were open to members and the fact that they were operating added greatly to the interest. In the machine shop particularly, where some very modern machines are installed, the economics of various operations were explained. In the assembly department, in addition to large mobile cranes in course of erection there were several trucks and one small mobile hoist which, surprisingly, could lift a ton and a half.

It is understood that at these works a new building is to be erected to house the drawing-office staff and their present offices are to be converted into an ablution centre. At the conclusion of the visit, which was thoroughly enjoyed, Mr. C. Nicholls, on behalf of the members, expressed thanks to the directors for permission to visit the works and to the various members of the staff for the trouble taken to make the visit so enjoyable. Mr. Smith, the works manager, promised to convey the expression of thanks to the directors.

Branch Dinner

The branch held its annual dinner at the Crown Hotel, Newcastle-upon-Tyne, on March 16, at which there was a large gathering of members, their ladies and friends. Unfortunately, due to congestion at the hotel, the party had to be separated into two rooms for the meal; although this arrangement undoubtedly interfered with the full enjoyment of the occasion, it did not dampen the ardour of the "Geordies" in doing full justice to the menu. Later, all moved to a larger room, which had been arranged for the entertainment programme of the evening. Mr. C. Nicholls, the branch president, introduced the artistes, who gave a first class entertainment and assisted very considerably in making the evening a memorable occasion for all who participated.

South Africa

Mr. J. A. de Kiewet presided over the January meeting of the South African branch, when Mr. J. Steele presented a Paper on "Present-day CO_2 Practice in South African Foundries." In the first part—"Materials and Equipment"—suitable sands; sand drying; and the type of equipment used for mixing, were dealt with, as also were secondary additives, and mould and core dressings. An illustration was given of an automatic timing device designed and manufactured locally. In the second part of the Paper details were given of methods in use and products at the various stages, including steel melting. In the melting shop CO_2 cores are used for the "S"-plate system of steel-ingot casting. The properties of sand collapsibility, surface finish of castings, and their dimensional accuracy were commented upon in considering fettling shop activities.

During the subsequent discussion, members related their experiences with the Process in their own foundries. Other topics included the addition of blacking to sand, the making of patternplates, and gravity-die-casting dies. The meeting closed with a vote of thanks, proposed by Mr. Coombs, which was enthusiastically accorded.

At the February meeting, a Paper on "Coated Abrasives" was presented by Mr. S. M. Gray, and a film on this subject was shown by courtesy of Norton Abrasives S.A. (Pty.), Limited. Mr. Gray introduced his Paper by outlining the origin and development of coated abrasives (commonly known as sand-paper). Problems which have confronted coated-abrasive manufacturers include the removal of hairs from peach skin and carbuncles from elephant hide. The original abrasive, silica sand, although still used, is being replaced to a great extent by silicon carbides and alumina approaching the hardness of diamonds. Methods of setting the abrasives on the synthetic-resin-coated backing-paper (or cloth) range from shaking on by hand to electro-deposition through a field of static electricity. Nowadays, coated-abrasive belts vary in width from ½ to 84 in., the latter having special loading mechanism to set them in position. The film shown at the meeting illustrated how coated abrasives were used for the removal of burrs on castings, contour cleaning and polishing; and various operations which were claimed to save considerable time as compared with grinding or milling. At the conclusion of the meeting, Mr. H. Holdsworth proposed a vote of thanks to Mr. Gray and Mr. Campbell-Pitt (of Norton Abrasives) for a most interesting and instructive evening, which was heartily accorded.

Works Visit

On February 17, members and friends of the branch spent the afternoon at the National Physical Laboratory in Pretoria. During the course of the visit, members were shown over the various departments of the laboratory, including the mechanical-testing section, and the heat-treatment laboratories. Various projects, dealing with investigation of mechanical failures of castings, were also shown and discussed. The visit was by courtesy of the Council for Scientific and Industrial Research.

West Wales

Mr. R. S. Turner presided when the West Wales section of the Wales and Monmouth branch held their last meeting of the session on March 23, at Swansea, at which Mr. J. H. Pearce, of the Sheffield branch, presented a Paper on the "Production of Heavy-steel Castings." This was followed by a coloured film entitled "Britain's Heaviest Steel Casting." Both the lecture and the film dealt with castings of a much larger type than most of the members present had experienced, and in the discussion the questions were mainly about the materials used and precautions necessary in the making of such large items. Replying to a question about the use of the electric arc for keeping risers molten, Mr. Pearce said such apparatus required frequent attention when in use, and it was not usually economically worth-while for small castings.

Mr. B. Godber proposed a vote of thanks be given the lecturer for presenting such an interesting Paper, and Mr. G. R. Jones seconded the proposal which was received with acclamation.

Metal-finishing Wastes

Effect on Sewage Purification

Discharges of waste waters from metal-finishing fall into two categories:—(1) The continuous discharge of considerable quantities of dilute rinsing and quenching waters, and (2) the batch discharge of smaller quantities of concentrated spent pickling, anodizing and cleaning solutions with occasional discharges of spoilt plating solutions. The concentration of metals sometimes in the form of complex cyanides, in plating baths, is very high, and the sudden discharge of solutions of high concentrations may have disastrous effects in sewage-treatment works, and in the river which receives the sewage effluent.

The chief dangers of attack on sewers by metal finishing wastes, states A. E. J. Pettet in his paper presented to the Institute of Metal Finishing and the Institute of Sewage Purification in London early this year, are from unneutralized acidity or from concentrations of neutral sulphates in excess of 1,000 p.p.m. SO_3. Cyanides in concentrations greater than 10 to 20 p.p.m. HCN, according to the size of the sewer, may release dangerous concentrations of hydrogen cyanide into the sewer air. The effects of constituents of metal-finishing wastes are not necessarily the same for different processes used at sewage-treatment works. Metals having insoluble hydroxides tend to be precipitated by the slightly alkaline sewage and may concentrate in the sludge. Copper and trivalent iron at concentrations less than 100 p.p.m. in wet sludge, nickel and trivalent chromium at concentrations above about 200 p.p.m. weight, and zinc at concentrations above 0.1 per cent. dry weight, have been stated to hinder digestion of sludge. It is, however, difficult, says the author, to relate the concentration of metal in sewage to the concentration to be expected in the sludge. Cyanide at a concentration of 1 p.p.m. HCN in wet sludge has a detectable effect on digestion. Up to 5,000 p.p.m. sodium chloride can be tolerated but 600 to 800 p.p.m. SO_4 in soluble sulphates reduces gas production and increases the proportion of hydrogen sulphide in the gas.

A concentration of about 1 p.p.m. copper, nickel, or zinc, has a detectable effect on purification by the activated-sludge process on a laboratory scale, the first effect being to increase the turbidity and reduce the concentration of oxidized nitrogen in the effluent. Rather higher concentrations appear to be tolerated by experimental percolating filters, the first detectable effect being to reduce nitrification. Cyanide at a concentration of 1 p.p.m. HCN has an initial effect on the activated-sludge process and on percolating filters, but the filters can become acclimatized to considerably higher concentrations. The concentrations of chromate which first have an effect on the activated-sludge process and on percolating filters are respectively 2 p.p.m. and 1 p.p.m. hexavalent chromium. Trivalent chromium has less effect than has hexavalent chromium on the activated-sludge process. Iron does not appear to be particularly toxic to aerobic biological processes.

To avoid serious interference with treatment of sewage, chemical pretreatment of metal-finishing wastes before discharge to a sewer is often necessary. Available processes include neutralization of acids and precipitation of metallic salts by addition of lime or other alkali, reduction of chromic acid by ferrous sulphate or sulphur dioxide before precipitation with lime, and removal of cyanides by complexing with ferrous sulphate or by oxidation with hypochlorite or permanganate. Cyanides are also amenable to biological treatment. For certain special applications, such as regeneration of chromic acid anodizing solutions, ion-exchange resins resistant to attack by chromic acid may prove to be useful.

Patterns Cast in Epoxy Resin

Addenda to Mr. D. B. Orr's Paper

Since the Paper under the above title was printed*, some foundries have evolved various practical improvements in the method of making patterns. For example, Mr. Mann, of Ransomes, Sims & Jefferies, Limited, describes the following simplified method of reinforcing epoxy-resin patternplates: Steel bars, $\frac{3}{8}$-in. wide and the same thickness as the plate—$\frac{7}{8}$ or 1 in.—are placed in the mould against the two longer sides, and between these two bars, at about 6 in. spacing, tie-rods are screwed or fitted into position. Across these rods, one sheet of expanded metal is laid—or fashioned, if the surface has curvature. This method has proved effective for plates 18 by 23 in. on a jolt/squeeze machine and Mr. Mann states it is much easier than the glass-cloth method described in the Paper.

S. Russell & Son, Limited have succeeded in dispensing with the stoving of moulds made of Mansfield sand. Their method is to skin-dry the sand mould with a gas torch and then paint it liberally with a pitch preparation which they have formulated. The pitch, when dry, plus a coat of varnish for cleanliness and the usual wax release, form a barrier to the remaining moisture in the sand mould. For their foundry layout this method is an improvement on the resin-hardened sand mould method described in the Paper and which was developed by Mr. Orr in co-operation with S. Russell & Son, Limited.

It is claimed epoxy resins are resistant to chemical attack and especially to attack from alkalis. Because of this property and also because the resins have no grain structure, coreboxes and patterns made of filled resin are suitable for all work employing the CO_2 process. No paint or varnish need be applied.

* Presented to the Slough section of the London branch of the Institute of British Foundrymen and printed in the JOURNAL November 10, 1955.

HEAD WRIGHTSON & COMPANY, LIMITED, announce that they have been entrusted with the design and manufacture of three blast-furnaces together with gas-cleaning plant and complete ore-preparation plant to a total value of approximately £11,000,000 for the Indian Government.

Imports and Exports of Iron and Steel in January and February

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in January and February, 1956. Totals for the first two months of 1956 and 1955 are also included.

Total Exports of Iron and Steel

Destination.	Month ended Jan. 31.	Month ended Feb. 29.	Two months ended February 29.	
	1956.	1956.	1955.	1956.
	Tons.	Tons.	Tons.	Tons.
Channel Islands	662	512	1,387	1,174
Cyprus	205	226	643	431
Sierra Leone	418	471	1,119	889
Gold Coast	1,727	2,154	4,814	3,881
Nigeria	5,669	5,495	7,521	11,172
Union of South Africa	9,221	8,588	17,392	17,809
Rhodesia and Nyasaland	3,894	3,843	7,060	7,737
Tanganyika	954	1,642	2,094	2,596
Kenya	4,158	3,673	6,106	7,813
Uganda	811	713	984	1,524
Anglo-Egyptian Sudan	2,165	1,744	2,929	3,909
Mauritius	127	100	337	227
Aden	354	724	2,626	1,078
Bahrain, Qatar, and Trucial States	823	1,025	1,525	1,848
Kuwait	129	137	764	266
India	28,470	26,404	23,322	54,884
Pakistan	5,955	4,146	15,631	10,101
Singapore	2,687	2,527	8,096	5,214
Malaya	2,762	2,075	2,890	4,837
Ceylon	2,730	1,556	3,163	4,286
British North Borneo	728	530	532	1,261
Hongkong	4,232	4,537	7,429	8,766
Australia	21,229	19,601	83,275	40,830
New Zealand	15,405	18,962	47,145	34,370
Canada	10,150	23,776	13,666	33,926
Jamaica	2,027	2,388	2,369	4,415
Trinidad	4,504	2,206	10,924	6,710
British Guiana	458	318	756	776
Other Commonwealth countries	1,653	1,979	4,027	3,632
Eire	5,169	5,858	8,537	11,053
Finland	2,728	5,123	14,234	7,851
Sweden	11,805	8,844	26,153	20,649
Norway	7,299	6,990	20,536	14,289
Denmark	5,040	4,614	16,250	9,654
Western Germany	1,158	1,362	1,612	2,520
Netherlands	7,165	7,228	19,180	14,387
Belgium	1,734	3,263	3,742	4,997
France	242	1,161	960	1,403
Switzerland	1,581	868	2,743	2,455
Portugal	926	293	1,587	1,219
Spain	2,049	741	1,532	2,790
Italy	1,411	2,199	4,211	3,610
Austria	592	285	408	877
Yugoslavia	—	1,167	3,669	1,167
Greece	332	867	1,639	1,199
Turkey	255	493	2,323	748
Netherlands Antilles	555	1,112	1,039	1,667
Portuguese E. Africa	443	149	320	592
Lebanon	42	1,584	92	1,626
Egypt	1,820	5,110	8,313	6,930
Israel	738	542	1,989	1,280
Saudi Arabia	34	1,896	2,244	1,930
Iraq	1,181	5,028	2,816	6,209
Iran	5,786	7,235	8,172	13,021
Burma	473	234	1,983	707
Thailand	1,498	565	1,102	2,063
Indonesia	1,333	390	473	1,723
Philippine Republic	256	300	968	556
USA	3,477	3,405	7,873	6,882
Cuba	826	1,164	664	1,990
Colombia	311	73	1,790	384
Venezuela	5,696	4,136	15,192	9,832
Ecuador	212	308	572	520
Peru	2,046	1,757	1,741	3,803
Chile	29	19	248	48
Uruguay	574	134	1,978	708
Argentina	4,068	3,700	7,766	7,737
Other foreign countries	1,773	2,173	6,838	3,944
TOTAL	216,964	234,422	484,015	451,382

Total Imports of Iron and Steel

From	Month ended Jan. 31.	Month ended Feb. 29.	Two months ended February 29 (using amended figures in certain cases).	
	1956.	1956.	1955.	1956.
	Tons.	Tons.	Tons.	Tons.
Rhodesia and Nyasaland	—	444	464	444
Australia	27	2	6	14
Canada	4,746	4,437	9,701	9,183
Other Commonwealth countries and Eire	437	870	297	1,307
Soviet Union	54,406	5,995	27,054	60,401
Sweden	4,279	3,125	4,820	7,404
Norway	7,939	12,984	12,520	20,923
Western Germany	18,000	17,507	2,496	35,059
Netherlands	12,965	11,736	15,824	23,903
Belgium	39,828	37,807	11,823	77,439
Luxembourg	9,573	6,137	3,807	15,740
France	39,093	25,919	12,003	65,206
Italy	392	1,473	67	1,865
Austria	21,521	11,068	24,054	32,604
Japan	685	2,893	1,159	3,578
USA	50,303	51,649	57,641	101,952
Other foreign countries	6,276	3,398	67	9,700
TOTAL	270,470	197,444	183,803	466,722
Iron and steel scrap and waste, fit only for the recovery of metal	112,844	83,801	184,708	196,608

Exports of Iron and Steel, by Product

Product.	Month ended Jan. 31.	Month ended Feb. 29.	Two months ended February 29.	
	1956.	1956.	1955.	1956.
	Tons.	Tons.	Tons.	Tons.
Pig-iron	7,417	8,078	10,140	15,495
Ferro-colombium (niobium)	11	17	35	28
Ferro-tungsten	67	66	40	133
Other ferro-alloys	281	263	382	544
Ingots, blooms, billets, slabs, sheet, and tin-plate bars	290	279	1,306	569
Iron bars, rods, angles, shapes, and sections	147	210	714	357
Steel bars, rods, angles, sections, and shapes	30,926	37,074	80,547	67,969
Iron plates and sheets	41	21	27	62
Universal plates	479	741	1,004	1,220
Steel plates, ⅛ in. and under ¼ in.	947	905	2,809	1,852
Do., ¼ in. and over	19,637	20,036	54,029	39,673
Black sheets and black plate	20,342	20,262	40,937	40,030
Hoop and strip	8,291	8,858	20,462	17,159
Tinplate	25,485	23,046	55,660	48,531
Decorated tinplate	198	1,131	645	1,329
Galvanized sheets	12,125	10,275	26,599	22,400
Other (incl. tinned sheets, terneplate, and ternesheets)	1,566	947	2,603	2,513
Railway and tramway construction material	24,757	28,011	39,410	52,748
Wire rods	3,264	2,079	5,379	5,343
Wire	7,999	8,335	19,230	16,337
Tubes, pipes, and fittings	52,023	63,339	119,236	115,370
Iron castings	160	101	1,594	261
Steel castings	141	121	240	262
Forgings	370	227	587	597
TOTAL	216,964	234,422	484,015	451,382

New Patents

(Copies of complete specifications are obtainable from the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s.)

742,920. Wikmanshytte Bouks Aktiebolag, Wikmanshyttan, Sweden.

A sintered hard-metal alloy suitable for drill inserts, particularly for rock drills. It contains tungsten carbide, as its main component and cobalt as its binding agent. The proportions by weight are tungsten carbide 84 to 91, W 3 to 7, and Co 6 to 9 per cent.

743,098. American Steel Foundries, 410 Nth Michigan Avenue, Chicago, Cook, Illinois, USA.

A railway knuckle-coupler casting having a tail section and a nose section interconnected by an intermediate section having a throat. A pivot pin extends lengthwise from top to bottom through the knuckle, such hole having an enlarged portion between its ends, the surface of such enlarged portion adjacent the throat being closer to the longitudinal axis of the hole than the remainder of the enlarged portion. The invention has amongst its objects the devising of an interlock between the cores accommodating quick assembly thereof in the mould, and the provision of a knuckle casting which can be more economically manufactured and which is stronger than those previously known in the prior art. Patent No. **743,104** deals with the core assembly for this knuckle-coupler.

743,433. Max Adolphe Bunford, 13 Boulevard Princesse Charlotte, Monte Carlo, Monaco.

A centrifugal casting machine. It consists of a container rotatable about an axis, a shell rotatably engaging in the container. The shell is rotatable about an axis and has in its interior a cavity for casting. A single drive means is provided for rotating the container about its axis and for rotating the shell about its axis, both axes being inclined to each other. The speed of rotation of the shell about one axis relative to the speed of rotation of the container and hence the shell about the other axis can be varied.

743,469. Mond Nickel Company, Limited, Sunderland House, Curzon Street, London, W.1. A process for the production of cast-iron containing magnesium in amounts such as to produce spheroidal graphite in the iron as cast if the iron is grey; or to cause carbides to break down to spheroidal graphite on subsequent heat-treatment if the iron is white. Iron richer in magnesium than is required is produced by introducing the magnesium into molten iron in a closed vessel. The magnesium-containing molten iron is then mixed with iron to which no magnesium has been added.

743,572. Miniere et Metallurgique de Rodange, Rodange, Luxembourg.

A process of rapidly refining ordinary steel in a converter for transforming the same into a high-quality steel of low-sulphur content. The molten steel is heated in a converter by addition thereto of metallic aluminium. The molten steel is violently agitated with a blast of air, the blowing being terminated while the steel is in the reducing phase.

743,613. L'Air Liquide, Societe Anonyme pour l'Etude et l'exploitation des Procedes Georges Claude, 75 Quai d'Orsay, Paris, 7e, France.

A new process for making steel containing boron. Steel in the molten state containing normal nitrogen and from which furnace slag has been removed is immediately treated in a separate vessel. As a source of boron, a slag comprising a borate from the group of alkali-metal borates, alkaline-earth metal borates and boron oxide, together with a boron liberating medium as reducing agent is added. At the same time, the metal is flushed with a non-oxidizing, nitrogen-free inert gas thereby to eliminate acid-soluble nitrogen, thereby to cause boron addition without interference by boron nitride.

743,992. Samuel Osborn & Company Limited, Clyde Steel Works, Wicker, Sheffield, 3, and L. N. Taylor.

Sampling and testing of molten steel by taking and preparing, from a bulk of molten steel in a furnace, a sample of the steel so that it can be subjected to chemical analysis to determine that the ultimate casting shall be of the required composition. The invention is only concerned with those steels having a composition such that the steel is capable of being hardened.

744,053. Northern Aluminium Company, Limited, Bush House, Aldwych, London, W.C.2, and F. Howitt, 13, Church Road, Edgbaston, Birmingham, 15.

Improvements in the control of automatic machines. These improvements are specifically related to aluminium casting machines.

744,150. Elliott Brothers (London) Limited, Century Works, Lewisham, London, S.W.13.

Manufacture of waveguide components. A thin metallic shell is electrodeposited on a mandrel, the shell is encased in a fluid or plastic material capable of assuming a relatively hard or rigid form. The encasing material may be moulded or cast to any required external shape by investing the metallic shell. The encasing material may thus be a low-melting-point metallic alloy.

744,236. William Jessop & Sons Limited, Brightside Works, Sheffield.

High-speed steels consisting of the following range of constituents in the amounts by weight as stated. Carbon 0.70 to 1.30, silicon 0.1 to 0.8, manganese 0.1 to 0.6, tungsten 12.0 to 23.0, chromium 2.0 to 5.0, vanadium 0.1 to 5.0, molybdenum 0.1 to 1.0, cobalt 0 to 20.9, boron 0.001 to 0.05 per cent. The remainder is iron and the usual impurities.

744,238. Berthold Zunckel Ruckersdorf/Mfr Ludwigshohe, Bavaria, Germany.

Improved method and apparatus for manufacturing cast mass-produced parts. The molten metal is cast in moulds of which the bottom is formed by the cooling plate. Opposite this bottom are the casting openings which are closed and opened by the metal admission means.

744,439. Joseph Jacobs, 1, Amerikastrasse, Cuxhaven, Germany.

A process for the manufacture of steel or cast iron from a cast-iron alloy. The cast-iron in the molten state is subjected to an incomplete air-blast process and subsequently sprayed and quenched. The air blast is continued until the carbon content of the molten cast iron melt is reduced to 0.15 to 3.0 per cent., preferably to 0.5 to 2.5 per cent.

744,464. J. A. Heron, Farnham Royal Lodge, Farnham Royal, Bucks.

A method of casting articles in refractory moulds. During the making of refractory moulds by investment of the patterns, a cavity or cavities supplementary to the mould cavity is formed. It is separated therefrom by an imperforate diaphragm or partition. It forms part of the moulding cavity wall but is of insufficient strength to produce deleterious stresses in the article being cast during solidification and contraction on cooling. The process is claimed to be very suitable for turbine blades and articles having re-entrant or concave surfaces.

Personal

Dr. T. HEAP, principal of Derby and District College of Technology, has been elected chairman of the Derby and district branch of the Institute of Industrial Administration.

Mr. C. A. MANGAN, Mr. E. M. OVERTON, Mr. R. G. PURNELL, and Mr. A. F. THOMAS, all assistant directors of the Delta Metal Company, Limited, have been appointed full directors.

MAJOR W. R. BROWN, D.S.O., has been elected vice-chairman of Power-Gas Corporation, Limited, Stockton-on-Tees, and MR. T. K. HARGREAVES, D.S.O., M.A., has been appointed a director.

The Distington Engineering Company, Limited, announces that Mr. T. WINTRUP hitherto described as sales manager (engineering) will in future be known as sales manager (general engineering).

British Transport Commission announce the appointment of Mr. E. J. LARKIN as director of works study. His main responsibilities will be the provision of the specialist work-study service and organizing a work-study training centre.

Mr. B. ENDLAR (John Dale, Limited) has succeeded Mr. O. G. HALLIWELL (J. Frankel (Aluminium), Limited), as chairman of the Federation of Light Metal Smelters. The new vice-chairman is Mr. R. HAHN (B.K.L. Alloys, Limited).

After 52 years' service with the Rubery Owen organization at Darlaston, Mr. CHARLES PARTRIDGE has retired. He joined the company as a junior at 3s. a week in 1904 and became a senior executive. He will remain on the board of directors.

Mr. C. BENNION has resigned as managing director of the British United Shoe Machinery Company, Limited, but will remain chairman. Mr. C. G. BENNION has been made managing director and Mr. G. W. HOLMES assistant managing director. Mr. J. L. LUTYENS has been appointed to the board.

A Derby man, Dr. RICHARD DODD, has been appointed an assistant professor of metallurgical engineering at the University of Pennsylvania. He was a research metallurgist of Rolls-Royce, Limited, at Derby from 1943 to 1948, when he became a research Fellow in Industrial Metallurgy at Birmingham University. He left this country to lecture in South Africa in 1950 and was there for four years. Recently he has been a research metallurgist in the Canadian Department of Mines.

Obituary

Mr. GEORGE HAUXWELL, senior partner in George Hauxwell & Sons, engineers, ironfounders, etc., of Durham City, has died at the age of 94.

Mr. TREVOR JONES, joint managing director of Lowe & Fletcher, Limited, lock manufacturers and brass founders, of Willenhall (Staffs), has died at the age of 59.

MR. ERNEST BROOK, founder and past chairman of Brook Motors, Limited, Empress Works, Huddersfield, makers of electric motors, died on April 16 at the age of 82. He began the production of motors in 1904 in a small room with two assistants and a capital of £300.

Mr. VERNON YOUNG, chairman of International Combustion, Limited, Derby, died on April 18 at the age of 64. Mr. Young was appointed a director of International Combustion (Holdings), Limited, in 1952, and chairman of International Combustion, Limited, and International Combustion Products, Limited, in 1955.

The death has occurred of Mr. SAMUEL DUCKITT, joint managing director of Moss Gear Company, Limited, Birmingham. He was 72. Mr. Duckitt joined the firm in 1913 and was appointed sales director on the creation of a public company in 1936. He became joint managing director on the death, in 1949, of his elder brother, Mr. W. Duckitt, the founder of the company.

Mr. JAMES MONTGOMERY, a director of the Clyde Alloy Steel Company, Limited, Motherwell, died on April 4. He joined the Colvilles, Limited, group of companies in 1912, served in the first world war, in which he was twice mentioned in dispatches, and went to the Glengarnock works on demobilization. He was there until 1934 when he was transferred to the Clyde Alloy Steel Company as assistant works manager. Eight years later he became works manager and joined the board in 1951. Mr. Montgomery was a member of the group's Training and Education Committee and of the British Iron and Steel Federation (Scottish Area) Training Committee.

Board Changes

BRITISH INSULATED CALLENDER'S CABLES, LIMITED—Mr. C. O. Boyse has been appointed a director.

WALMSLEY'S (BURY), LIMITED—Mr. R. J. Burns, technical manager, has been appointed to the board.

CONSETT IRON COMPANY, LIMITED—Mr. Frank B. George, general works manager, has been appointed general manager with a full seat on the board.

MATHER & PLATT, LIMITED—Mr. Roy C. Mather retired from the board at the annual meeting on March 22 after serving the company for over 50 years.

FORD MOTOR COMPANY, LIMITED—Sir Patrick Hennessy, deputy chairman and managing director, will succeed Sir Rowland Smith as chairman on April 20.

IMPERIAL CHEMICAL INDUSTRIES, LIMITED—Mr. J. L. Armstrong, finance director, has retired from the board. Mr. P. T. Menzies has been appointed an additional director and has taken over the duties of finance director.

PULSOMETER ENGINEERING COMPANY, LIMITED—Mr. John Dalgleish and Mr. Arthur Dennis have joined the board as chairman and vice-chairman respectively. Mr. Stanley Woodrow will continue as managing director.

SIMPLEX ELECTRIC COMPANY, LIMITED—Mr. J. D. Johnson, who has been appointed a director, will continue in his present capacity with the company, a subsidiary of Tube Investments, Limited, as commercial manager of the Simplex division.

PLESSEY COMPANY, LIMITED—Mr. B. Blair, who joined the company in 1938 as works engineer, Mr. A. A. Chinnery, manager of the equipment division since 1950, and Mr. R. Keir Watson, general manager of the Swindon factory since 1953, have been appointed executive directors.

ALBRIGHT & WILSON, LIMITED—Sir Henry Tizard, FRS, a director of Solway Chemicals, Limited, and a member of the National Research Development Corporation, and Mr. Frank Schon, chairman of Marchon Products, Limited, and Solway Chemicals, have been appointed to the board.

News in Brief

BIRMINGHAM CITY COUNCIL have made a grant of £500 for research into factory planning.

AN AMERICAN COMPANY is adding boron and bismuth to pearlitic-malleable iron to enable them to produce heavier section material with the same annealing cycle.

ARCHIBALD BAIRD & SONS, LIMITED, Clyde Steel & Engineering Works, Wellhall Road, Hamilton, are to erect baths and toilets at their works at an estimated cost of £6,700.

AT THE PRODUCTION EXHIBITION (Olympia, May 23-31), on the Mond Nickel stand (No. 3, Row F), a section will be devoted to the properties of s.-g. iron, with examples of its use.

BRITISH STANDARDS INSTITUTION have just issued B.S. 1304: 1956—"Ready-to-Fit" thermal insulating materials for hot- and cold-water supply and central-heating installations for small dwellings.

A NEW DRAWING OFFICE to replace premises at Southwick, Sunderland, destroyed by fire last September, is to be erected by Aiton & Company, Limited, pipework specialists, ironfounders, etc., of Derby.

AMONGST THE EXHIBITS of the forthcoming Düsseldorf International Foundry Exhibition will be one staged by the *Giesserie Institut* of Aachen, and will include an item referring to the classic work of Rambush and Taylor on the quenching of a cupola during its operation.

ATLAS COPCO (GREAT BRITAIN), LIMITED, Beresford Avenue, Wembley, Middlesex, report the supply, spread over the last 18 months, of a number of 8-cwt. air hoists. It is stated that in some units working under arduous conditions, the hoists achieved a daily average of 1,800 operations.

DR. R. BEECHING, chairman of the metals division of ICI, Limited, presented long-service awards to 63 men and 11 women employees when they were entertained to dinner at the Witton Works, Birmingham, on April 20. Six further presentation ceremonies are to be held during April and May.

WHEN a Leeds-Birmingham goods express overran points near Cotton Lane, Derby, it crashed through the stop block and into the furnace room of John Smith & Company, brass founders, Derby, who have works by the rail-side. Six furnaces were put out of commission. Fortunately the firm have other furnaces in the foundry which can be used.

PART of a comprehensive engineering research and test centre, which is being constructed by Vauxhall Motors, Limited, on a 57-acre site at Chaul End, four miles west of its Luton (Beds) factory, will come into operation next month. The centre is being constructed in four phases and when completed in 1959 the total cost will be £320,000.

"PRINCIPLES OF PENETRANT METHODS OF FLAW DETECTION" is to be discussed at a meeting of the non-destructive testing group of the Institute of Physics, to be held on May 4, at 6.30 p.m., in the Institute's house. Anyone wishing to attend is advised to apply as early as possible for a ticket to the deputy secretary, the Institute of Physics, 47, Belgrave Square, London, S.W.1.

NEW RESEARCH LABORATORIES at the Newport, Mon., factory of Monsanto Chemicals, Limited, were officially opened on April 17, by Sir Cyril Hinshelwood, president of the Royal Society. They were named the Rideal Laboratories in honour of Professor Sir Eric Rideal, F.R.S., consultant to, and until recently a director of, Monsanto Chemicals, Limited, who was present at the ceremony.

FORTY-TWO-THOUSAND MILES on one set of tyres without a puncture is the record of Mr. George Lilley, a lorry driver in the transport department of Samuel Osborn & Company, Limited, steelmakers, Sheffield. At the fourth annual dinner of the department on April 13, he was among 13 drivers who received safe driving awards presented by Mr. C. F. Hurst, the firm's deputy chairman.

AFTER presenting gold watches to long-service employees of the Brooke Tool Manufacturing Company, Limited, at its Greet works in Birmingham on April 16, Mr. A. G. B. Owen received a watch in recognition of his own long service as chairman. Both he and the 15 employees honoured had completed 25 years with the firm. The presentation to Mr. Owen was made by Mr. Albert Lacey, a foreman with 43 years' service.

A NEW SPORTING CALENDAR received from The Eyre Smelting Company, Limited, Tandem Works, Merton Abbey, London, S.W.19, covers the twelve months commencing April 1, 1956. This year there is an enlarged feature of the lists of sporting achievements and forecast of events. Readers who would like to have these lists printed on a card for hanging in the sports club or canteen can be supplied with copies on writing to Tandem Works.

A CHAIR OF REFRACTORIES—the first of its kind in this country—is to be established at Sheffield University. This has been made possible by a gift of £15,000 from J. & J. Dyson, Limited, of Stannington, near Sheffield. The Refractories Department of Sheffield University has achieved a high international reputation for the brilliant research work carried out by the late Dr. W. J. Rees and Dr. Sarjant. The first holder of the newly-created chair is to be Dr. James White.

THE GROUP headed by Richardsons Westgarth & Company, Limited, has formed a new company, Richardsons Westgarth Atomic, Limited, with a capital of £250,000. It will design nuclear power units for both cargo ships and land-based power stations. The chairman of the new subsidiary, which will have its headquarters in London, is Mr. Harry Fothergill, and the other directors are Mr. O. J. Phillipson and Mr. J. R. Mackay. All are serving as directors of the parent company.

THE INSTITUTE OF MATERIALS HANDLING—Southern division—is organizing a two-day course for students, graduate members and applicants to these two grades. It is being held on two different days, June 7 and 14, at Management House, 8, Hill Street, London, W.1. Lectures 1 and 2 on the 7th, and Lectures 3 and 4 being on the 14th. The cost is £2 2s. 0d. and applications should be made to the secretary, the Institute of Materials Handling, 20/21, Took's Court, Cursitor Street, London, E.C.4.

MR. JAMES GEORGE WEIR, of G. & J. Weir, Limited, Holm Foundry, Cathcart, Glasgow, a former Bank of England director, who gave £25,000 in 1954 to University College, Oxford, in memory of his son, Colin Weir, M.C., a former member of the College, has now presented another £25,000. The first gift was for a fellowship for the study for politics, with special

News in Brief

reference to international affairs. The latest is for a fellowship to be devoted to the study of one of the physical or biological sciences.

WORK HAS JUST BEEN COMMENCED on a new extension at the Stannington plant of J. & J. Dyson, Limited. This extension is, in effect, a complete production unit, and will produce the same goods as those being manufactured at present, namely, refractory casting-pit hollow-ware. The entire plant is contained in one block measuring approximately 180 by 360 ft., and the output should be in the region of 800 to 1,000 tons of hollow-ware per month. The total cost is estimated at some £250,000, and completion is expected to be early in 1957.

DAVY & UNITED ENGINEERING COMPANY, LIMITED, Darnall, Sheffield, has secured an order worth £500,000 for the supply of roller tables in Australia. The tables are for a new slabbing mill which Australian Iron & Steel, Limited, is installing at its Port Kembla works in New South Wales. The Sheffield firm is supplying about 4,800 tons of new machinery for this contract, which is due for delivery early in 1957. Davy & United are also working on a contract for a continuous hot-strip and skelp mill for the Broken Hill Proprietary Company, Limited, the parent company of Australian Iron & Steel.

DEWRANCE & COMPANY, LIMITED, Great Dover Street, London, S.E.1, announce the formation of a special alloys division. This division will handle "Endewrance" high alloys which are particularly suited for components in industry where heat, abrasion, corrosion, and erosion resistant qualities are necessary. These alloys will be available as machined and unmachined castings or in the form of welding rods. This division also handles the company's patent T.L.B. metal-powder deposition process and powdered metals suitable for high-temperature brazing. The firm is working in close collaboration with Coast Alloys, Inc., Little Ferry, New Jersey, for the development and sale of high-alloy castings in this country, the Commonwealth and a number of European countries.

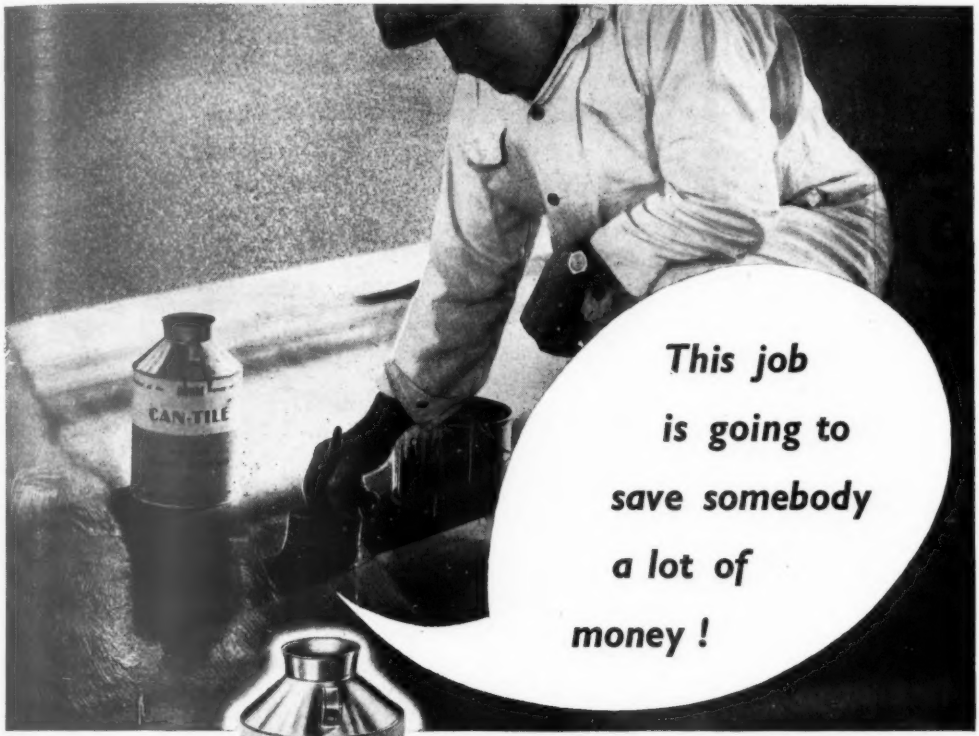
IT WAS REPORTED to the monthly meeting on April 17, of the Midland Regional Board for Industry in Birmingham, that figures for new factory building show that in the West Midlands, last year's monthly average of 1,000,000 sq. ft. of new building approved has been maintained during the first three months of 1956—from January to March, 134 projects covering more than 3,000,000 sq. ft. were given location approval. It was also stated that the number of workers known to be on short time had fallen below 30,000 after having risen to 39,000 during the Easter holiday period. The latest total for unemployed for mid-March was 14,197, an increase of 875 on the February figure. During March, 1,850 workers were notified as redundant as compared with 850 in February.

MR. EVAN AG. NORTON, chairman of Charles Clifford, Limited, told shareholders at the annual meeting of the company in Birmingham on April 12, that although Mr. James Gough has been compelled through ill-health to resign from his directorship of the company and of its subsidiary, Metallisation, Limited, he has agreed to continue in a consultative capacity. Similarly, Mr. E. H. M. White, who retired from the position of joint managing director last June, is remaining on the board as a non-executive director. Mr. Norton said that the firm's new subsidiary, Metallisation (Scotland), Limited, has made good progress and promises to justify the company's faith in starting the new business in Scotland. The board has approved an expenditure of approximately £100,000 towards the development of the Dogpool works. It is hoped soon to begin building operations there.

THE REPORT FOR 1955 of the Professional Engineers' Appointments Bureau, 9, Victoria Street, S.W.1, emphasizes the continued shortage of civil, mechanical and electrical engineers. In 1955, there was no significant change in the numbers of engineers registering with the Bureau, but the number of vacancies notified increased by 20 per cent. The total placings rose by 15 per cent. above last year's figure but the more rigid specification of requirements laid down both by those registered and by prospective employers, tended to reduce the field of selection. A larger proportion of placings was for senior appointments but with fewer men available for junior posts, the number of placings in the low salary ranges was reduced. The Registrar is always glad to offer the facilities of the Bureau to any corporate member, graduate or student of the Institutions of Civil, of Mechanical and of Electrical Engineers who is contemplating a change of post, and to any employer who wishes to fill a vacancy.

FOUNDRY EQUIPMENT, LIMITED, claim that their stand (No. D.301/200) at the British Industries Fair, Castle Bromwich, is the *largest* stand under cover in the whole of the Fair. They are showing two J.P.M.1 automatic jolt/squeeze moulding machines with pneumatic hopper-gate feed and a new type of segmented wire rope bucket elevator, also a length platform type mould conveyor and a vibratory knockout of new design. To feed these machines there is a compact sand plant comprising vibratory screen, feeder-belt, magnetic pulley and B.M.2 sand mill. Other equipment comprises a smaller sand mill, a skip loader, feed unit, and a No. 1 "Senior" sandrammer. The H.E.B.1 boxless moulding machine and the SP.10 double-station shell-moulding machine are being demonstrated. One associate company, Feslente, Limited, are showing pre-coated sand being used for shell moulding, and another, Transmission Accessories, Limited, an entirely new segmented-wire overhead called an FE-Line conveyor and also a range of pneumatic valves, which the firm is making under licence from Numatics Inc. of America.

AT A CONFERENCE in Birmingham, on April 18, on standardization and simplification, Mr. F. E. Butcher, design manager of Joseph Lucas, Limited, described a scheme adopted by his firm whereby, by standardizing the thickness of electrical terminals, a saving of 8 cwt. of brass a week had been achieved. Previously a multiplicity of terminals had been used, including 60 different types of eyelet. He claimed that as a result of the standardization, car manufacturers could cut by 20 min. the time taken to assemble each car. Representatives of some 200 firms attended the conference, which was organized by the Birmingham Productivity Association. Mr. A. B. Waring, chairman of the Association, said that individualism among manufacturers and resistance from sales force were the greatest obstacles to simplification and variety-reduction. Sir Anthony Bowlby, a director of Guest, Keen & Nettlefolds, Limited, recalled a war time crisis that had only been averted by quick simplification, resulting in one type of bolt being adopted at different factories for the same jobs. Mr. H. A. R. Binney, director of the British Standards Institution, said that some manufacturers insisted on a "deliberate perpetuation of an unnecessary diversity of spares" in order to ensure a continuing market for their products. This was a dangerous practice at a time when international markets were demanding greater interchangeability of spares.



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14 FACTORIES PULVERISING — SAVING INDUSTRY MONEY

Raw Material Markets

Iron and Steel

Overall production of pig-iron is now more in keeping with demand. Although some grades are still scarce, pressure for supplies has eased to some extent, and consumers appear to be receiving more adequate deliveries than for some time past.

Major effort is still concentrated on the supply of basic pig-iron to the steelworks, which also absorb a good proportion of the current output of hematite. At present, deliveries appear to meet requirements, but, with the scheduled expansion in ingot outputs, larger tonnages of raw materials will be needed. Home deliveries of pig-iron to the steelworks continue to be augmented by supplies from overseas, but from an economic point of view it is desirable to reduce imports as much as possible.

The new furnaces recently blown in and those to be brought into production later will add appreciably to current supplies.

The steelworks continue to be very busy and they have to depend mainly on adequate supplies of pig-iron being available, as arisings of scrap fluctuate and some areas are short of supplies. Outputs of pig-iron are, of course, dependent on sufficient raw materials being available. So far, consignments of ore from both home and overseas sources have provided adequate tonnages, which have met requirements and have also enabled the furnaces to augment stocks. It is, however, essential that there should be no interruption in deliveries, and on this account the reduction in supplies from North Africa is causing concern.

Of the foundry grades of pig-iron, high-phosphorus iron is the most easily obtainable, as owing to the reduced demand for light castings the foundries have not for some time been taking their normal supplies.

There is now, however, a slight improvement in demand from the light foundries, and this has increased their demands for pig-iron. The jobbing, textile, and some of the engineering foundries are taking up fair tonnages, but so far the furnaces have had little or no difficulty in coping with their demands. Outputs will be reduced when a furnace producing this grade in the Derbyshire area is blown out shortly for a period of about three months for relining and repairs, but on present demands it is expected that overall supplies will be adequate.

Low-phosphorus irons and hematite are still in good demand and producers are covered for their outputs. Some of the engineering and speciality foundries which cater chiefly for the motor-vehicle industry are not so busy and a few of them find it necessary to reduce the working week, but other trades which use high-duty castings are specifying freely.

Non-ferrous Metals

Although markets were attempting to firm up a little at the beginning of the week, overall they are inclined to show little strength. Indeed, yesterday (Wednesday) copper prices in London fell drastically and at the end of morning trading a loss of £16 10s. was shown over the 24-hour period, with a similar fall in three months metal. All the other metals eased further, with a loss of £2 in prompt and forward lead. Zinc lost 35s. In tin, cash and three months showed a fall, both quotations returning £754 to £754 10s.

As may be expected, in copper, following the almost continuous easing of the price, is reflected a situation where buyers are, as always, holding off in a falling market. At present buying is for immediate usage and consumers take the view that time is on their side. World production is expanding rapidly and warehouse stocks are steadily growing. However, the necessity to re-enter the market cannot be far away and figures for world consumption are still impressively high.

In the United States it is thought that the US producers' price of 46 cents a pound will soon be tested. At present Custom smelters are quoting 47½ cents for May metal, at which price the offtake is only fair. No. 2 copper scrap is currently quoted at 38½ cents by the Custom smelters, but offerings are reported to be light.

The London tin market remains steady, but the political situation in the Far and Middle East is being carefully watched. In the States there is interest in the future rate of production to be maintained by the Texas smelter, which will depend on the terms of the contracts due for renewal between the US and Bolivia, Indonesia, and the Belgian Congo.

Lead has been very quiet both here and in the States. Demand in London is of a routine nature and there is no shortage of metal to meet inquiries. The US market is dull on the basis of 16 cents a pound. Although demand for zinc is relatively good the price has declined in sympathy with the other metals. In the UK inquiries are expanding for g.o.b. metal from the galvanizing trade. In the US dealings are steady at 13½ cents, East St. Louis, "Prime Western" grade.

Official metal prices were as follow:—

COPPER, Standard—*Cash:* April 19, £363 to £364; April 20, £364 to £365; April 23, £370 to £370 10s.; April 24, £372 10s. to £373 10s.; April 25, £356 to £357.

Three Months: April 19, £357 to £357 10s.; April 20, £357 10s. to £358; April 23, £363 10s. to £364; April 24, £366 10s. to £367; April 25, £350 to £350 10s.

TIN, Standard—*Cash:* April 19, £761 to £762; April 20, £764 to £765; April 23, £758 to £759; April 24, £757 10s. to £758 10s.; April 25, £754 to £754 10s.

Three Months: April 19, £756 to £757; April 20, £759 to £760; April 23, £757 to £757 10s.; April 24, £757 to £757 10s.; April 25, £754 to £754 10s.

LEAD—*Second half April:* April 19, £113 to £113 5s.; April 20, £113 to £113 5s.; April 23, £113 10s. to £114; April 24, £113 15s. to £114; April 25, £111 15s. to £112.

Second half July: April 19, £112 15s. to £113; April 20, £112 10s. to £112 15s.; April 23, £113 5s. to £113 10s.; April 24, £113 5s. to £113 10s.; April 25, £111 5s. to £111 10s.

ZINC—*Second half April:* April 19, £98 to £98 10s.; April 20, £97 10s. to £97 15s.; April 23, £98 to £98 5s.; April 24, £98 to £98 5s.; April 25, £96 5s. to £96 10s.

Second half July: April 19, £96 15s. to £97; April 20, £96 10s. to £96 15s.; April 23, £96 15s. to £97; April 24, £96 15s. to £97; April 25, £95 to £95 5s.

Further CO_2 Process Discussions?

For the benefit of those who were disappointed on the first occasion of the London discussion on the CO_2 Process, organized by the British Cast Iron Research Association, the Association proposes, if sufficient interest is shown, to repeat the programme (again in London) during the week commencing May 28. The first session of the conference would run from about 4 to 7 p.m. on May 29, followed by morning and afternoon sessions on May 30, the proceedings terminating at about 4 p.m.—most of the official speakers at the earlier meeting have agreed to repeat their contributions. Ample accommodation will be available and no restrictions placed on the attendance of any of those who were present at the first discussion.